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Group Treatment Evaluation for Metal Finishers

CENTEC Corp.
Reston, VA

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GROUP TREATMENT EVALUATION FOR METAL FINISHERS

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FOREWORD

When energy and material resources are extracted, processed, converted, and used, the related pollutional impacts on our environment and even on our health often require that new and increasingly more efficient pollution control methods be used. The Industrial Environmental Research Laboratory - Cincinnati (IERL-Ci) assists in developing and demonstrating new and improved methodologies that will meet these needs both efficiently and economically.

This report defines the economic and technical basis for which group treatment of metal finishing wastes is feasible. An example site, the Huntington Industrial Park in Providence, Rhode Island, was chosen for this feasibility study. It was presumed that this park could be used as an example for similar groups of platers that might be able to consolidate their treatment capacity in a single central facility.

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ABSTRACT

Group treatment is one alternative for firms faced with the problem of compliance with pretreatment regulations whereby they may achieve the benefits of economy of scale. A preliminary study of the concept as applied to the plating firms within Huntington Industrial Park, Providence, RI, was conducted. It was found that, with the assumed 10 participating firms, substantial savings could be realized. The effects of financing cost and wastewater hauling charge on savings achieved were investigated, as were the benefits of installation of a piped wastewater collection system. The most cost-effective decision for each participating firm was identified. An approach to financing the proposed facility was outlined. The method of analysis illustrated herein is suitable to serve as a protocol for other similar groups wishing to assess the feasibility of joint treatment.

This preliminary analysis illustrated the considerable potential of the group treatment concept for reducing the costs of pretreatment to the industrial park participants. The proposed facility also has potential for service to a wider community, offering small plating job shops a means of complying with regulations while minimizing economic impact.

The next phase of the work required to bring this effort to fruition should include, in addition to definition of the financing obtainable, detailed engineering design. This would include site selection and layout, treatment process specification and layout, transportation system and/or piping system design, and detailed capital and operating cost estimates all of which would lead to working drawings and specifications. Resource recovery at the Group Treatment Facility should be evaluated and included in the design if economic. Detailed engineering design coupled with firm financing plans will allow accurate projection of the costs to each participant.

This report was submitted in fulfillment of Work Effort No. 2, Contract No. 68-03-2907 under the sponsorship of the U.S. Environmental Protection Agency. This report covers the period February-June 1980.

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SECTION 1

INTRODUCTION AND BACKGROUND

INTRODUCTION

Various economic evaluations have shown that joint treatment offers significant savings in capital and operating cost for manufacturing facilities that have similar wastes and that are located within a reasonable distance. Although many factors affect the economics, generalized studies show that a substantial portion of these capital savings is attained when greater than 10 facilities are combined.

One option to reaching these savings is through regional centralized treatment. This concept is being investigated through other IERL activities. Another important option, private group treatment, exclusive of any region-wide activity, also appears to have merit.

Since earlier studies, many additional incentives for group treatment have arisen. New government financing alternatives and the increased likelihood of significant pretreatment requirements combined with RCRA requirements for sludge disposal have all increased.

This study is aimed at providing a financial and technical package designed to minimize economic penalties for Group Treatment participants by utilizing:

- The most advantageous financing
- The most economic and effective technology
- A structure for the financing and technology which meets the needs of all participants.

BACKGROUND

The Environmental Protection Agency (EPA) is currently proposing and promulgating a series of industrial wastewater pretreatment regulations that will reduce the introduction of industrial wastewater pollutant parameters to Publicly Owned Treatment Works (POTW).

The metal finishing industry, because the nature of its waste discharge is such that it can seriously interfere with the proper operation of POTW's, will be one of the industries most affected by these regulations.[1] Various process wastewater control and treatment technologies will be required and could have an adverse economic effect, especially for small plants with limited personnel and capital.

At the 1979 Joint EPA/AES Conference on Advanced Pollution Control, EPA's Centralized Treatment Program[2] was described. It was pointed out that the Office of Research and Development at EPA had sponsored research to investigate means of reducing the anticipated economic impact on industry in complying with pending wastewater and solid waste regulations. Regional centralized treatment was one promising means identified; economy of scale and improved waste management are primary benefits. The results of preliminary studies on the economics of the centralized treatment approach were also presented at that conference.[3] It was shown there that the major portion of the economy of scale benefit of the centralized treatment concept could be realized when as few as 10 shops decide to participate in the arrangement (Figure 1).

Another promising approach to obtaining the benefits of economy of scale in industrial waste treatment is termed Group Treatment. Group treatment, as the term is used here, refers to the joint establishment of a waste treatment facility by a group of shops in close proximity, having similar wastes. Ownership, management, and operation would generally involve the participating companies themselves, although a number of variants are possible. The Group Treatment Facility (GTF), while primarily intended for the benefit of its members, could in addition offer to treat the wastes of other small shops having similar waste consituents.

Such group treatment facilities are becoming common in parts of Europe and in Japan. Switzerland and the Pforzheim region of Germany have instituted such arrangements. In Japan, with government assistance, electroplaters have relocated to parks where they can easily share waste treatment technology. "In the last several years no fewer than ten industrial parks [one firm to each building] and factory apartments [one building co-owned and occupied by several firms] for electroplaters have been planned and constructed throughout the country."[4]

Chuo Electroplating Industrial Park, built on 5 acres on an island in Tokyo Bay, is the largest of the parks. Nineteen platers are included (10 of them small job shops forming a united company). The opportunity to relocate and to redesign production lines resulted in modern in-line recycling and recovery systems within each member shop. Combined process

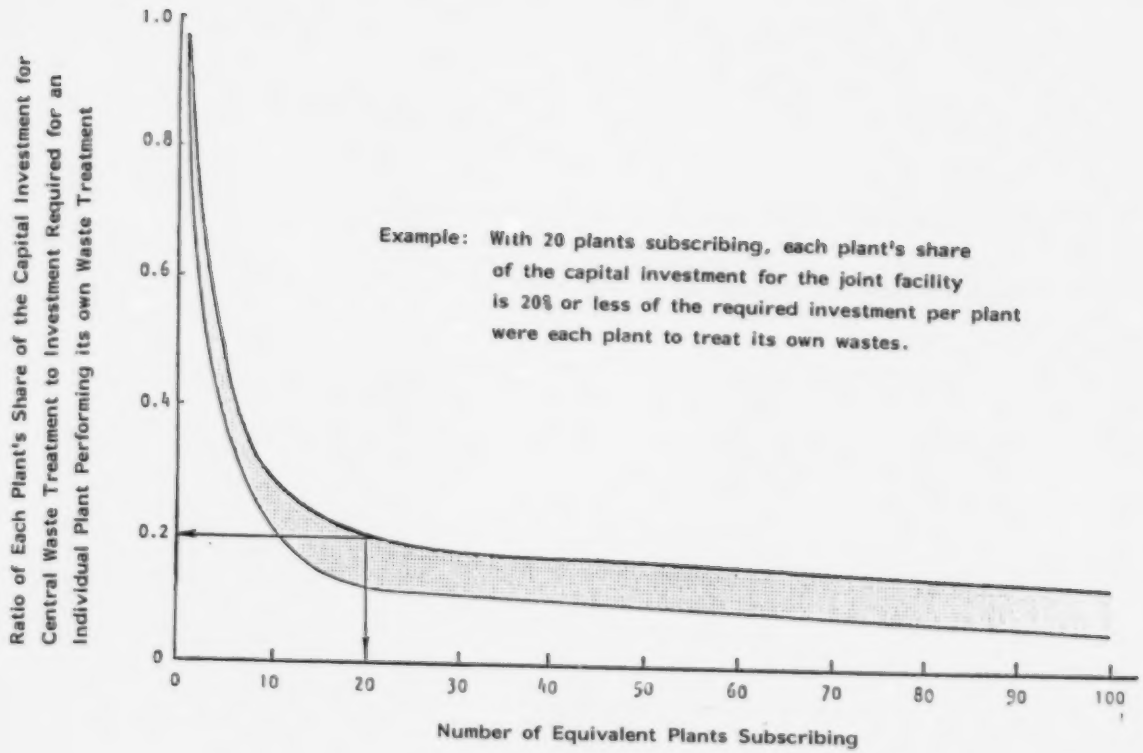
Ratio of Each Plant's Share of the Capital Investment for Central Waste Treatment to Investment Required for an Individual Plant Performing its own Waste Treatment
1.0
0.8
0.6
0.4
0.2
0
0
10
20
30
40
50
60
70
80
90
100
Number of Equivalent Plants Subscribing
Example: With 20 plants subscribing, each plant's share of the capital investment for the joint facility is 20% or less of the required investment per plant were each plant to treat its own wastes.

Figure 1. Effect of centralized waste treatment systems on capital cost per plant (from reference 3).

water discharge was reduced to a tenth of what it had been--from 1,100,000 liters per day to 110,000 liters per day.

The collective treatment facility at Chuo Industrial Park includes technologies for nickel and copper recovery (by ion exchange and electrolysis), chromic acid recovery from contaminated chromium plating baths (electrodialysis), a regeneration system for spent ion exchange cartridges, and conventional precipitation and dewatering facilities for settling out solids and concentrating sludges. Fixed expenses of the joint treatment facility are shared monthly by all of the members, regardless of the extent to which they have used the facility, on the basis of the area which each member occupies in the park. These expenses include wages and the cost of servicing the debt. On the other hand, variable costs of operation for the month are shared by the members according to the volume and concentration of each type of waste sent to the collective facility by the member.

In the United States, there have been previous studies of the group treatment concept. The Environmental Protection Agency provided a grant in 1977 to study the feasibility of joint treatment of plating wastes in Taunton, Massachusetts.[5] A unique feature of this region, however, was the fact that stringent local pretreatment regulations had forced most potential participants to have already committed themselves to a treatment scheme. Thus, only three firms participated in the study. Because the firms were some distance apart, and because only piping of wastewater was considered, it was found uneconomical to treat concentrated rinsewater jointly, but it was found that a joint facility to treat batch dumps in common could provide an operating cost advantage. Certain institutional problems were identified, such as the need to ensure that feasibility of the arrangement did not depend significantly on future business decisions of one of the participants. Financing, at the time of the study, was found most likely to depend on the existence of a single company that was financially strong enough to borrow the necessary funds. The concept was found to have considerable promise, but it was not suitable for the particular participants and circumstances existing in Taunton at that time. The required economies of scale were not reached.

At present (June 1980), the Brooklyn Economic Development Corporation is studying the concept of a "Plating City", wherein some of the electroplating industry in Brooklyn, New York, would be consolidated in an industrial park incorporating cogeneration and joint wastewater treatment facilities.[6] The initial study shows considerable potential cost benefit to the participants. While the plating city concept, unlike the present study, involves moving of platers and energy cost reduction through cogeneration of process steam and electricity, the Brooklyn study did find that a group of 10 assumed platers

(consisting of eight small and medium shops and two large shops) would reduce both their investment costs and their annual operating costs each by a factor of approximately two by joint rather than individual treatment.

SECTION 2

CONCLUSIONS AND RECOMMENDATIONS

The proposed Group Treatment Facility has been shown to be feasible for Huntington Industrial Park and to effect considerable cost savings for the participants when compared to their costs of complying with the pretreatment regulations individually. Installation of an industrial sewer system within the park, while more than doubling the demands for initial capital, would be cost-effective in the long run. While the analysis performed considered only conventional treatment processes, further study is warranted to investigate the benefits of recovery technology for copper and nickel at the GTF. The process capacities at the GTF have been arrived at by considering the needs of the group treatment participants within the park. Relatively small additional investment would allow process capacities to be increased so that the same facility could accept similar wastes from some of the very small job shops in the region, those which otherwise would be most severely impacted by the pretreatment regulations.

Each participant must carefully analyze his own operation and take steps to concentrate the wastes which he sends to the GTF. In the analysis performed here, it has been assumed that the flow rate of all running rinses would be minimized by installation of countercurrent rinsing at all stations where this was calculated to be cost effective. In addition, careful sampling of all running rinses should be performed to determine which can go directly to the POTW without pretreatment. In place of, or in addition to counter-current rinses, still rinse installation prior to each running rinse should be evaluated. When the still rinse contains concentrations so high that the subsequent running rinse could not go directly to the sewer, the still rinse tank would be emptied into a storage tank to await shipment to the GTF. Of course, each plant should be certain that good housekeeping practices are in effect to minimize dragout, control spills, and recover plating bath solutions where possible.

Figure 2 shows the actions required by each of the plants which is able to concentrate its wastewater sufficiently to ship it economically to the GTF. According to the analysis presented herein, nearly all of the plants at Huntington Industrial Park

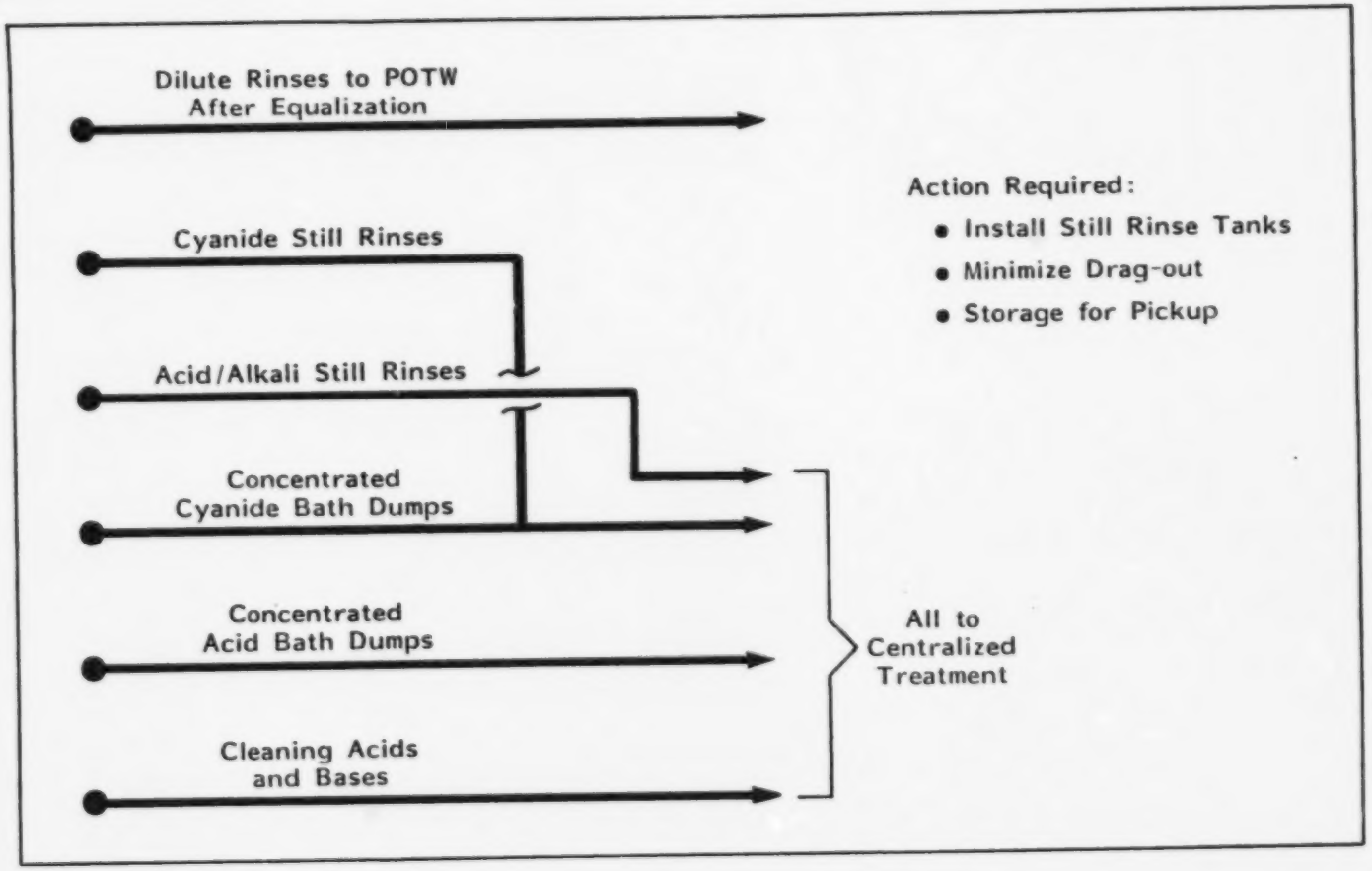

Figure 2. Options for small facilities if group treatment is available.

fall into this category. Those plants which, even after flow minimization, still could not afford to ship their wastewater to the GTF, would exercise the option shown in Figure 3, involving some in-plant treatment with dilute sludge shipped to the GTF. This option may apply to one or two of the plants within the park, although, with maximum attention to flow reduction, it is believed likely that those plants would also send all of their wastewater requiring treatment to the GTF.

The capital required has been estimated as $300,000 to $800,000. The SBA Pollution Control Financing Guarantee Program is very attractive for such amounts, particularly when combined with an issue of tax-exempt bonds. It is recommended that the Huntington Industrial Park participants contact the SBA Office of Special Guarantees, an experienced underwriter, and the Rhode Island Department of Economic Development to explore this financing option.

The Group Treatment Facility at Huntington Industrial Park would require a permit from the State of Rhode Island authorizing it to operate as a Hazardous Waste Treatment Facility. Truck hauling of the wastewater would be required to comply with applicable regulations concerning the transport of hazardous wastes. The GTF will, in addition, be faced with the cost of disposing of the dewatered sludge in an environmentally safe manner, in an approved hazardous material landfill (assuming that such sludges are classified as hazardous). These costs were not considered in the analysis of savings to be achieved through group treatment, since the same costs, proportionately, would have to be borne by the participants were they to choose to treat their wastes individually. The GTF may, in fact, effect some savings here since it would be shipping to the landfill by 15 cubic meter truck loads rather than by the drum. One of the first actions to be undertaken by the participants should be identification of an ultimate disposal site and the associated costs, since no approved hazardous material disposal site exists within the State of Rhode Island.

This preliminary analysis has illustrated the considerable potential of the group treatment concept for reducing the costs of pretreatment to the industrial park participants. As has been noted, the proposed facility also has potential for service to a wider community, offering small plating job shops a means of complying with regulations while minimizing economic impact. The GTF costs and savings presented here have been based on operation of the facility on a two-shift basis. Additional capacity to treat wastes from outside the park could be gained by going to three-shift operation. Or, the initial facility design could be resized based on single shift operation, providing considerable room to increase operating hours and to process additional wastes.

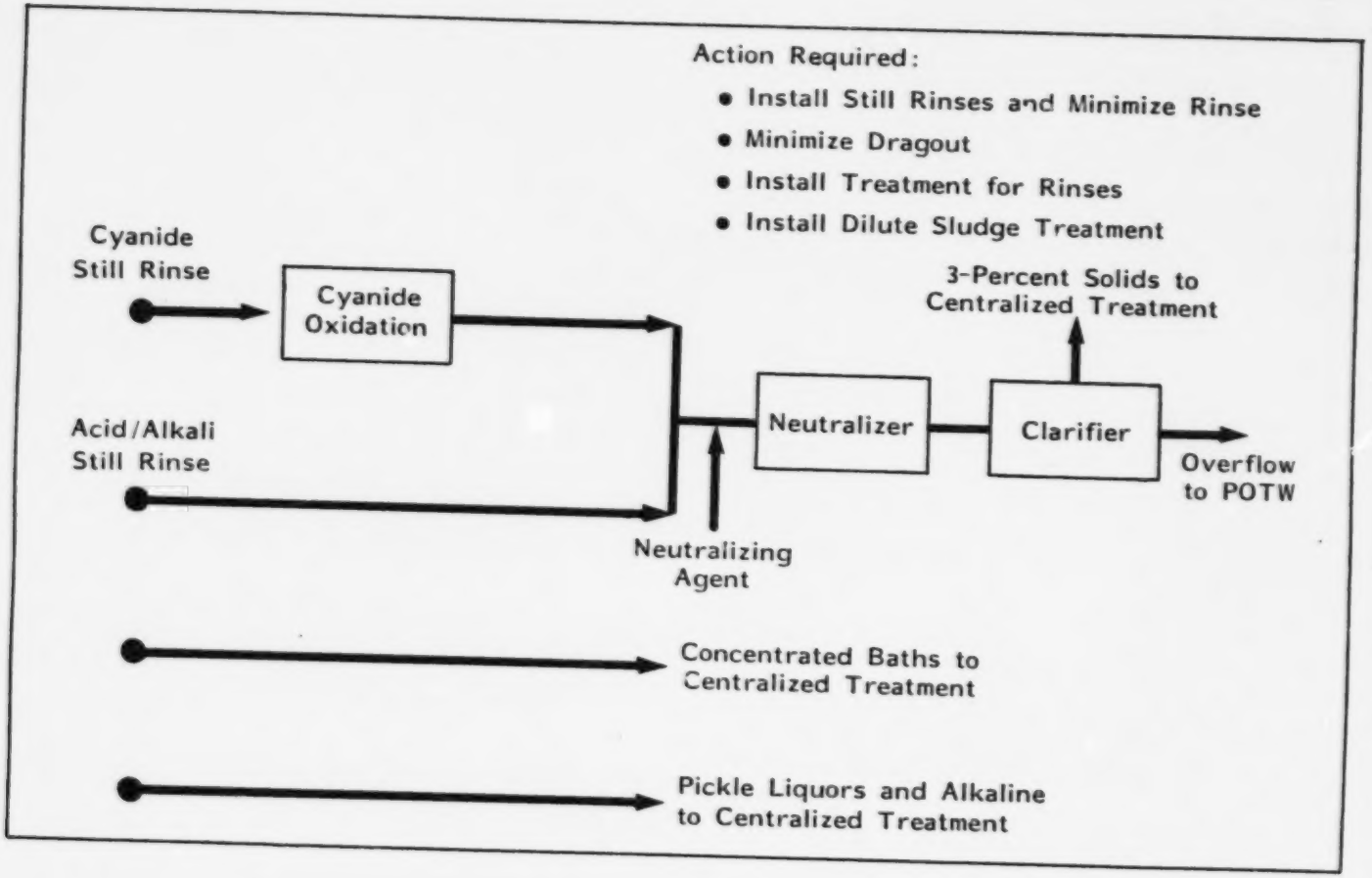

Figure 3. Intermediate options for plant if group treatment is available.

The next phase of the work required to bring a project such as this to fruition should include, in addition to definition of the financing obtainable, detailed engineering design. This would include site selection and layout, treatment process specification and layout, transportation system and/or piping system design, detailed capital and operating cost estimates, leading to working drawings and specifications. Resource recovery at the GTF should be evaluated and included in the design if economic. Detailed engineering design coupled with firm financing plans will allow accurate projection of the costs to each participant.

SECTION 3

HUNTINGTON INDUSTRIAL PARK

Huntington Industrial Park is located within Providence at the Cranston, RI, boundary. It is well served by highways and nearby access ramps. Although on the outskirts of the city of Providence, it is centrally located with regard to the bulk of the electroplating and jewelry industry in the area.

The park is about 10 years old. Although not planned as an electroplating park, there is presently a concentration of plants performing plating. Eleven plants within the park fall into that category. Each of the firms is in the business of jewelry manufacturing with the exception of one plating job shop and one electronics concern. The plants involved range in size from 25 to 350 employees. The average number of working days per year for these firms is 242. All are one-shift operations, and the length of a shift is 8 hours in all but two cases.

Several of the firms perform precious metals plating. Gold and silver are generally recovered using in-line processes (electrolysis, ion exchange). Most of the firms make extensive use of cyanide baths. There is very little use of chromium (chromium was found in small quantity in the effluent of only two plants). In addition to cyanide, typical effluents include copper, nickel, and zinc. Some effluents show substantial iron. Little cadmium or lead is in evidence.

Each of the companies presently discharges its industrial waste streams to the City of Providence POTW. Each of the firms may expect to be impacted to some extent by the mandated requirements for pretreatment.

Figure 4 presents a sketch noting the location of the firms that perform plating within the park.

INCENTIVES AND REGULATORY STRUCTURES

Pretreatment standards[1] for the electroplating point-source category were published on September 7, 1979, with an effective date of October 9, 1979, and a compliance date of October 12, 1982. The regulations identify eight subcategories to which modified effluent limitations apply. Those of primary

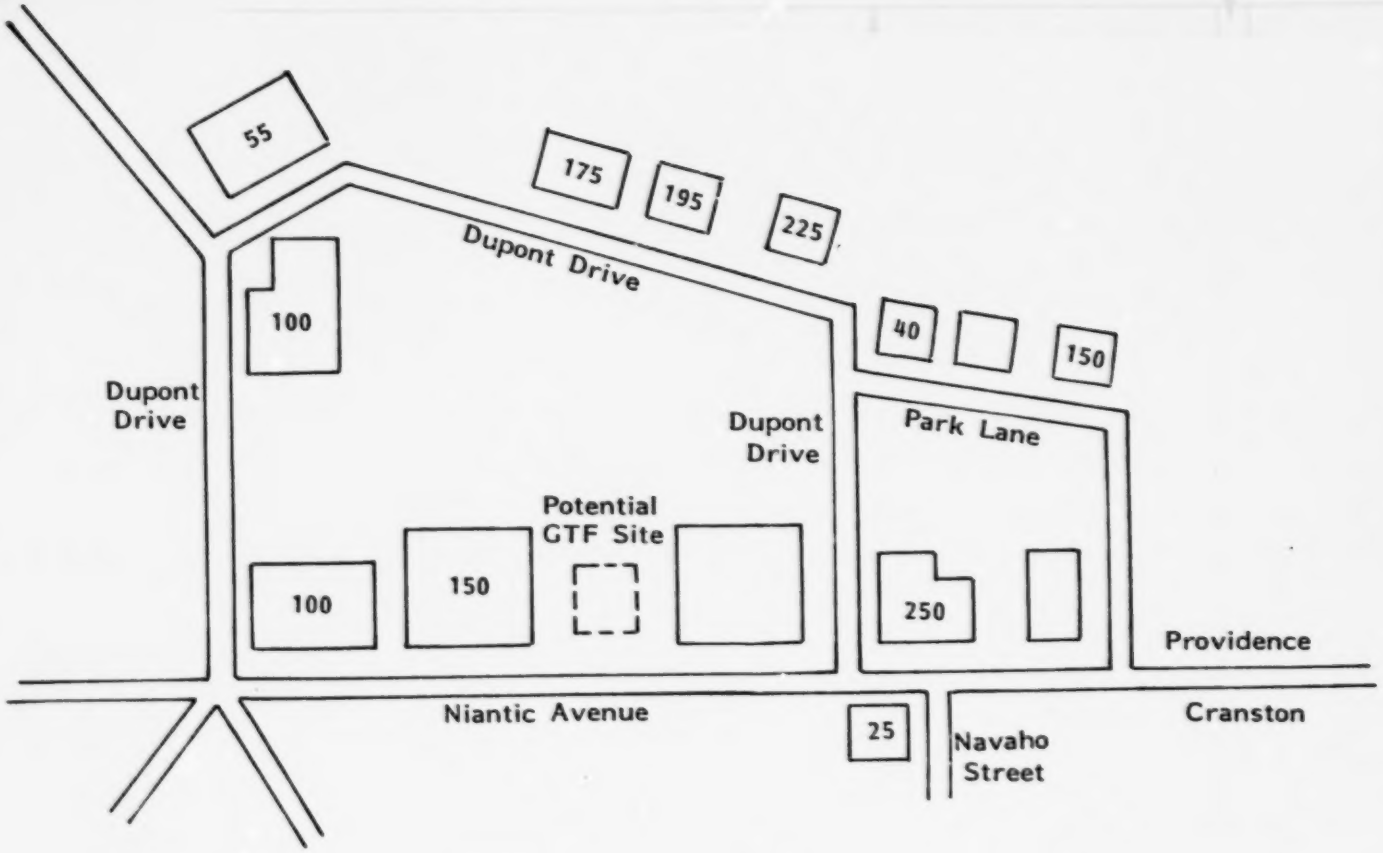

Figure 4. Huntington Industrial Park -- Providence, RI.

concern to the plants in Huntington Industrial Park are the Common Metals Subcategory and the Precious Metals Subcategory. The major difference between these subcategories is the addition of a limitation on the discharge of silver in the case of precious metals. The City of Providence presently intends to enforce standards identical to those of the Federal requirements. The existence of the 1982 compliance date means that methods of complying with the pretreatment regulations must be considered at an early stage. Thus, EPA's Office of Research and Development has sponsored this study of group treatment at Huntington Industrial Park as a case study which might be useful as a guide for similar industrial groupings.

The Providence, RI region, in which Huntington Industrial Park is located, presents a unique situation with regard to electroplating concentration. No other area in the country has such a high proportion of electroplating firms with respect to the general population. The city presently receives large concentrations of metals in its influent and calculates that it discharges as much as $30,000 worth of silver each week into Narragansett Bay. The jewelry industry is heavily represented. While it has been estimated[1] that compliance with pretreatment regulations may force about 20 percent of firms in the job shop sector out of business nationally (and other estimates have placed this figure at between 30 and 60 percent)[1], the regional impact of such closures, were they to occur, might be expected to be nowhere of greater significance than in the Providence area. A group treatment facility at Huntington Industrial Park, then, in addition to serving its founding firms, would have the further potential of providing economical waste treatment to those small job shops in close proximity, which might otherwise be severely impacted.

PLANT CHARACTERIZATION

In order to determine wastestream flows and pollutant concentrations being discharged by the firms in the park, each potential participant was visited for the purpose of sampling during the week of February 15, 1980. Ten firms indicated sufficient interest in the project to allow a sampling team of three persons to spend, on the average, one-half day in each plant.

Wastewater streams were divided into cyanide-bearing and other (general acid/alkali). The flow from the first running rinse following each cyanide bath (expected to carry most of the cyanide to the sewer) was measured and a composite sample of the cyanide stream was prepared, the contribution from each rinse being proportional to the flow rate which had been determined. In addition, samples of the final effluent were obtained. Each of the plants' final effluent, at the point measured, consisted of only process water. At one plant, samples were obtained of

four different types of process solutions just prior to scheduled batch dumping. The layout of each plating line was determined, and schematic drawings were prepared. Information on type, volume, and frequency of each batch dump was obtained. Rinse stations on each plating line were examined to note those at which meaningful flow reduction measures were in place (counter-current rinse, still-rinse, etc.), and those which were candidates for incorporation of flow-reduction measures. The percent of normal production underway at the time of sampling was noted for each firm.

Samples collected from each plant (except for two which were not in operation at the time of the visit) were submitted to CENTEC Analytical Services, Inc., Salem, Virginia. Analyses were performed for total cyanide, cyanide amenable to chlorination, cadmium, chromium (total and hexavalent), copper, iron, nickel, lead, zinc, and silver (Appendix A). Concentrations that were measured were corrected to full production based on the assumption that wastewater flows are unchanged regardless of the level of production. The final effluent flow rates, generally not convenient for measurement, were calculated by multiplying the measured cyanide stream flow rate by the ratio of measured total cyanide concentrations, cyanide stream to final effluent. Analyzed concentrations were corrected for batch dumps using actual concentration data for the one plant where batch dump samples were taken; the remaining plants' concentrations were adjusted using average pollutant data for each category of batch dump as supplied by the Manufacturing Jewelers and Silversmiths of America, Inc. (James E. Thibault, personal communication, March 13, 1980).

Two methods of batch dump adjustment were used. In the first, all dumps with a frequency of once each 2 weeks or greater were considered to have occurred on the same day. This gave a worst-case figure for comparison with the 1-day maximum regulations. The second method averaged all batch dumps over a 1-month period to find a daily mean. Results of the first method were used to assist in determining which plants might exceed maximum limits. Results of the second method were used to represent the average daily pollutant load requiring treatment.

The two plants which are potential participants, but which were not in operation at the time of sampling, were represented as the average of the other eight firms for which data were available. Flow rates for the 10 plants ranged from 15,140 to 246,025 liters per day (4,000 to 65,000 gallons per day). Every plant except one was found to exceed cyanide limitations on the final effluent. That plant, because its effluent flow is less than 37,850 liters per day (10,000 gallons per day), did not exceed applicable limitations with regard to any pollutant parameter. Nevertheless, it was included in the analysis

because, should local regulations ever impose the same limitations for all parameters presently indicated for plants with flows greater than 37,850 liters per day (10,000 gallons per day), it would be out of compliance for some parameters.

TRANSPORTATION AND DISPOSAL OPTIONS

Assumptions

Transportation to the group treatment facility was assumed initially to be by 18,925-liter (5000-gallon) tank truck. The cost of shipping 5000 gallons by truck to the GTF was varied from $20.00 to $40.00. (A typical charge for wastewater hauling is $40 per hour.) The interest rate on borrowed funds was varied from 6 percent to 18 percent. Each plant was assumed to require a 20 percent return on investment before committing capital to in-house treatment technology. That is, a plant is considered to ship its wastes to the GTF unless by constructing in-house treatment facilities it can realize a savings providing a return on invested capital of at least 20 percent.

Piping of Wastewater to the GTF

While truck hauling of wastes was assumed in the primary analysis, the possibility of constructing an industrial wastewater sewer system within the park was also considered. A double pipe system, designed to carry cyanide and noncyanide wastes separately, was evaluated. Two designs were considered, one a collection system based on gravity flow, the other a pump-assisted system. Figure 5 shows a schematic of the collection system (single pipeline shown) with manholes indicated (17 per line). The basis of the cost estimate is shown in Table 1, and Table 2 presents the breakdown of the estimated cost.

TREATMENT AND RECOVERY TECHNOLOGIES

The technologies reviewed in this section have become widely used in the metal finishing industry. These technologies are expected to be the basis for the treatment configuration to be installed at individual industrial sites or at a central or group treatment facility.

A flow diagram of a conventional treatment facility for metal finishing wastes is provided in Figure 6, and a discussion of the technologies follows.

Chromium Reduction

Chromium complexes are usually present in electroplating wastewater as trivalent chromium (Cr^{+3}) or as hexavalent chromium (Cr^{+6}). Although most heavy metals are readily

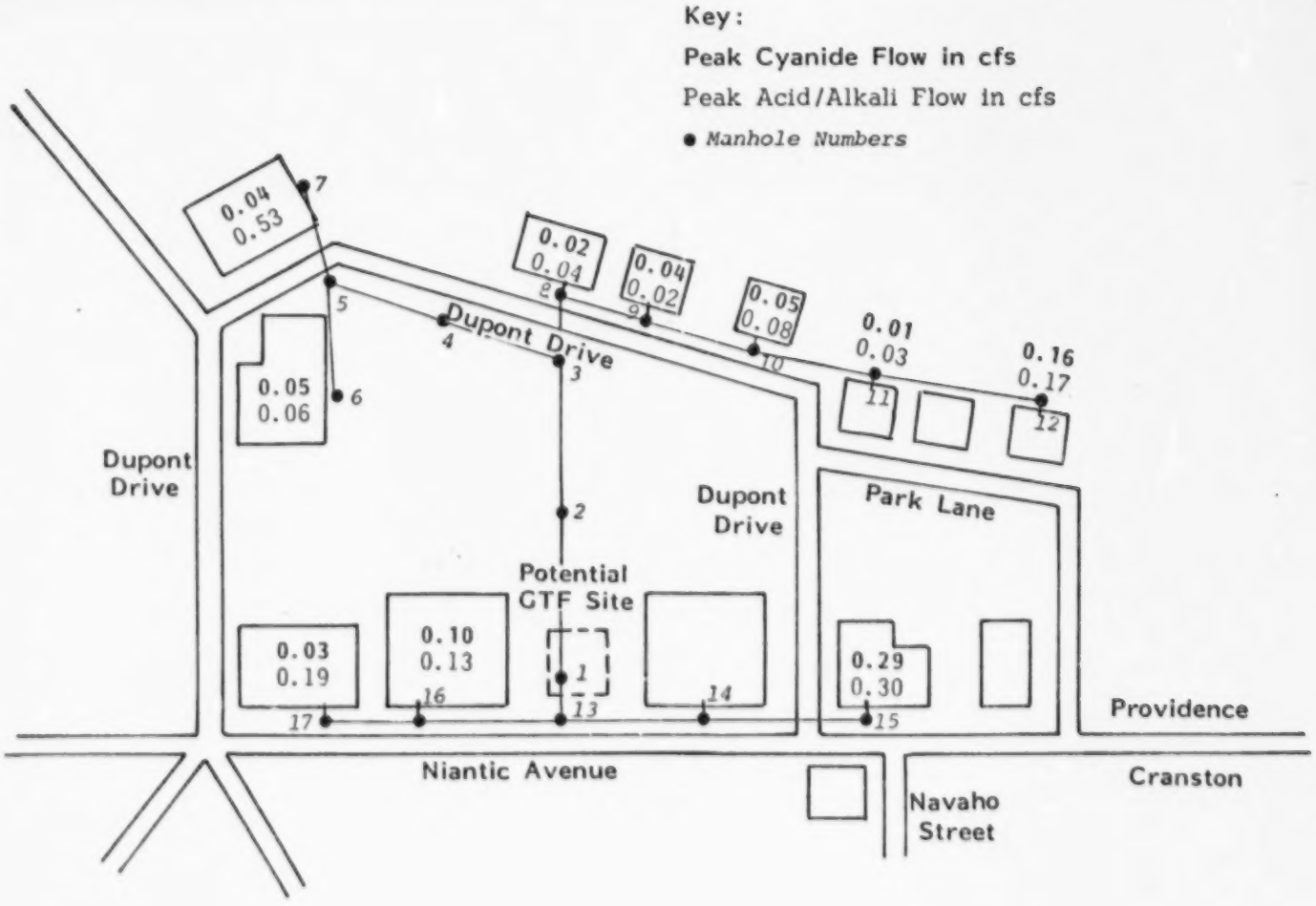

Figure 5. Schematic of proposed piped wastewater collecting system.

TABLE 1. COLLECTION SYSTEM COST ESTIMATE ASSUMPTIONS AND PROCEDURES

Design 1

- Based on peak flows (2.0 times present actual average daily flow) during actual hour of plant operation only.
- Collection system configuration as shown in Figure 5 for single system. Actual system will use same trends for collection pipe wherever possible.
- Design cost estimates.
- Local (Providence, RI) materials and labor costs.
- Depth to groundwater assumed = 1.829 meters (6 feet) (trench will be dewatered using native materials, as necessary).
- Select backfill used to protect pipe (at 8 m^3/m).
- Economy for using same trench for 2 systems - 25 percent.
- Asphalt replacement necessary for 2.438-meter (8-foot) width along 20 percent of trench length (1.6 m^2/m).

Design 2

- If local codes do not permit use of minimal slopes for small diameter pipes (even though no gross solids are anticipated), it may be necessary to consider a design alternative to the proposed gravity collection system. One alternative would involve installation at each site of a collection sump for each waste stream, a low horsepower pump [559.5 watts (3/4 hp) or less], and controls. The previously designed gravity collection system would simply receive wastes by pumping at a uniform rate when a sufficient waste volume has accumulated at each location, thereby avoiding low flow volumes and velocities. Costs are estimated to be $2,000 per installation for 20 installations, totaling an additional $40,000 (in excess of Design 1 costs).

TABLE 2. COST ESTIMATE - HUNTINGTON INDUSTRIAL PARK WASTEWATER COLLECTION SYSTEM

Item	Quantities No.	Units	Engineering Unit Cost	Estimate Cost
Pipe, including excavation placing, jointing, and backfilling:				
15.24 cm PVC	8770	LF	25.00	219,250
20.32 cm PVC	1650	LF	30.00	49,500
SUBTOTAL				268,750
Economy - use single trench for placement of both pipes where possible; Deduct 25 percent				-67,190
SUBTOTAL				201,560
Manholes	34	EA	1500.00	51,000
Select Backfill	1540	CY	8.00	12,320
Dewatering	5210	LF	1.50	7,820
Asphalt Replacement	900	SY	2.50	2,250
SUBTOTAL				274,950
A&E @ 10 percent				27,500
Contingency @ 15 percent				41,240
TOTAL				$343,690
				$344,000

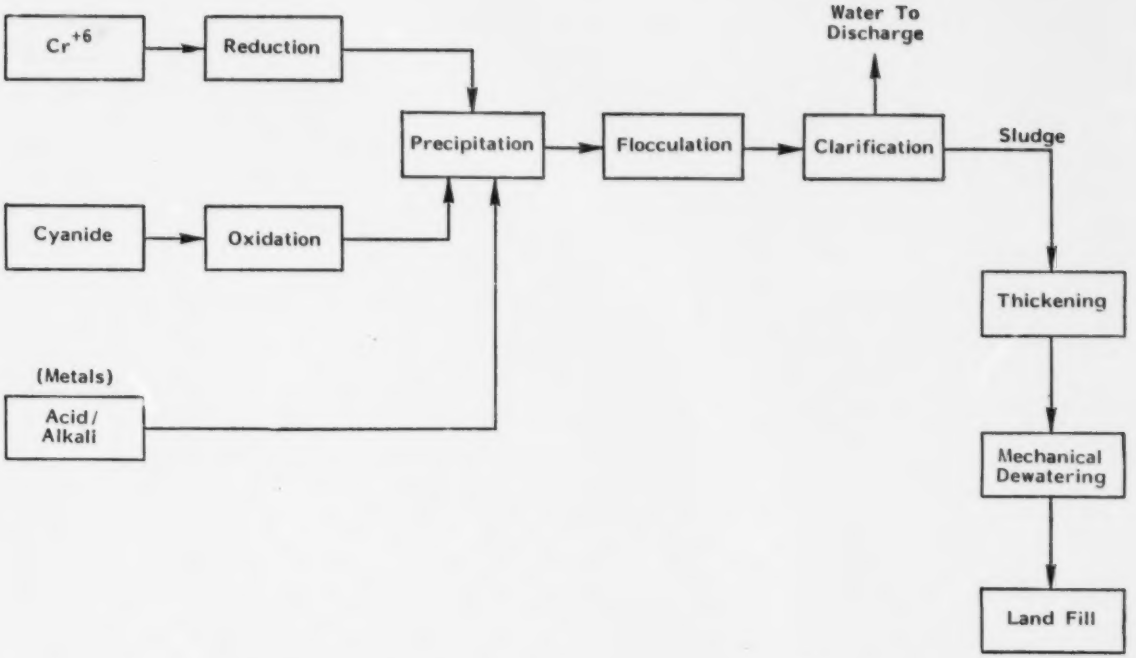

Figure 6. Conventional treatment technology flow diagram.

precipitated as insoluble by pH adjustment, hexavalent chromium first must be reduced to trivalent chromium. This is usually done by reaction with gaseous sulfur dioxide (SO_2) or with a solution of sodium bisulfite ($NaHSO_3$). The net reaction using sulfur dioxide follows:

$$3SO_2 + 2H_2CrO_4 + 3H_2O \longrightarrow Cr_2(SO_4)_3 + 5H_2O$$

Since the reaction proceeds rapidly at low pH, an acid is added to control the pH of the chromic acid wastewater between 2 and 3. The reducing agent is continuously metered into the reaction tank to satisfy the reduction demand based on the concentration of hexavalent chromium.

Cyanide Oxidation

Dilute cyanide rinse streams resulting from plating operations and cyanide dips also must be treated separately, first to oxidize the highly toxic cyanate and then to convert it to harmless bicarbonates and nitrogen. The oxidation reagent is usually chlorine which can be introduced into the system by adding chlorine gas (Cl_2) or sodium hypochlorite ($NaOCl$). Typical reactions are:

- Using Chlorine

  First Stage: $NaCN + 2NaOH + Cl_2 \longrightarrow NaCNO + 2NaCl + H_2O$

  Second Stage: $2NaCNO + 5NaOH + 3Cl_2 \longrightarrow 6NaCl + CO_2 + N_2 + NaHCO_3 + 2H_2O$

- Using Sodium Hypochlorite

  First Stage: $NaCN + NaOCl \longrightarrow NaCNO + NaCl$

  Second Stage: $2NaCNO + 3NaOCl + H_2O \longrightarrow 3NaCl + N_2 + 2NaHCO_3$

Continuous systems use two series-connected reaction tanks. In the first stage, the pH is adjusted between 9 and 11 using an alkali such as caustic or lime. The pH in the second reaction chamber is controlled at approximately 8.5. Chlorine is added continuously to both stages. Since the demand for chlorine in the second stage is proportional to demand in the first stage, the chlorine is fed to both stages from the same feeder at a set ratio based on demand in the first stage. Demand in the first stage is determined by measurement of Oxidation Reduction Potential (ORP). The reaction time needed is approximately 25 to 30 minutes in each stage.

Neutralization/Precipitation Techniques

The mixed acid/alkali wastes streams from the various metal cleaning and plating operations are combined with the effluent from the chromium reduction and cyanide oxidation steps in the neutralizer. Since the heavy metals are soluble at low pH (acidic) conditions in the wastewater, the pH is adjusted to a range of 7.5 to 9.5. In this pH range, the minimum solubility of a mixture of metals is reached, and the metals precipitate as hydroxides.

Many types of neutralization systems can be designed with various degrees of automation and controls depending on the volumetric flow rates and on the variability of the flow rates or pH entering the neutralizer. Because a change of one pH unit represents a ten-fold change in hydrogen-ion concentration, maintaining the pH in the narrow range where maximum removal of pollutants is realized will be difficult if the neutralizer feed is subject to wide variations.

Single-stage, continuous neutralizers in which all of the alkali such as lime ($CaOH_2$), or caustic soda (NaOH), is fed into a single reaction vessel are usually suitable for electroplating applications. If, however, the wastewater is subject to rapid changes in flow rates or pH, a multistage neutralizer is required. In the multistage units, the majority of the alkali is added in the first vessel to increase the pH to 6. Final pH adjustments of the wastewater are made in the remaining reaction vessels to promote precipitation and to enhance the settling characteristics of the metal hydroxides. To maintain adequate pH control, the retention time for typical neutralization systems is 10 to 30 minutes. A system using lime normally requires more retention time because the time required to completely dissolve the lime retards the response of the system to the reagent addition.

Flocculation and Clarification

Metal hydroxides and other insoluble pollutants are removed from the wastewater by gravity settling. The solids removal efficiency depends on the settling rate of suspended solids in the wastewater feed. Typically, some of these solids settle very slowly because of their small particle size and minimum density difference compared to the water. Since economical design of the clarifier limits the retention time in the settling chamber, some level of suspended solids will appear in the overflow.

To enhance the settling characteristics of the suspended solids, coagulants such as alum or ferrous sulfate are added in a mixing chamber prior to the flocculator. In the flocculator,

polymers are added, and the wastewater is gently agitated to allow the solids to agglomerate. The wastewater then enters the clarifier where the solids settle out. The solids in the underflow can be discharged to a hold tank for thickening or can be discharged directly to sludge disposal. The optimum dosages of flocculating agents, the size and costs for flocculation and clarification hardware, and the associated solids removal efficiencies can be estimated only by laboratory testing.

Sludge Thickening

The solids from clarifiers are typically discharged to sludge holding tanks at solids concentrations of 0.5 to 3 percent; overflow from the tank is recycled to the clarifier. Usually metal hydroxide solids will concentrate to approximately 3 to 5 percent solids in these tanks if given adequate retention times. These tanks also provide adequate storage time and volume for the sludge prior to shipment to a disposal site.

Further concentration of the thickened sludge requires the use of mechanical dewatering equipment. Centrifuges, rotary vacuum filters, belt filters, and filter presses have been utilized to dewater metal hydroxide sludge. The applicability of a particular dewatering device for a specific sludge and the degree of cake dryness it will achieve can be determined only by bench-scale testing with the intended feed material.

Mechanical Dewatering

Plants employ dewatering devices for either one of two reasons: to make the sludge suitable for disposal at a local site that will accept only nonflowing sludges or to reduce the cost of disposal so that investment in the required equipment is economically justifiable.

Mechanical dewatering devices that have been used successfully to concentrate metal hydroxide sludge include:

- Vacuum Filters - These units dewater sludge by applying a vacuum on one side of a water permeable membrane which has a sludge layer or suspension on the other side. In response to the pressure gradient, the water passes through the membrane. Rotary-drum and vacuum-belt filter methods utilize this principle. Vacuum filters perform best with feed solids concentrations above 3 percent solids by weight; sludge containing lower feed solids concentrations should be thickened prior to vacuum filtration.

- Pressure Filters - These units pressurize the sludge and contact it with a water permeable membrane. Recessed plate filter presses use this method to dewater sludge.

They can dewater sludges to high solids content because of the large pressure gradient they can apply across the sludge cake; commercial units are designed that have operating pressure limits as high as 15,820 grams per square centimeter gauge (225 psig).

Filter presses are able to dewater feeds streams that are very dilute or subject to wide variations in feed solid concentration. For small applications, filter presses generally represent the least capital cost alternative for sludge dewatering.

ANALYSIS OF GROUP TREATMENT ECONOMICS

The existing Centralized Treatment microcomputer model was used to analyze the data obtained as described previously. While each of the treatment steps considered in the preceding section is included in the model, chromium reduction did not enter into the analysis since the chromium present is negligible. The analysis is basically a trade-off of the economy-of-scale savings resulting from joint treatment against the added costs resulting from the need to transport the wastes. The model consists of a series of treatment process cost equations, based on U.S. EPA published relations.[7,8] All costs are updated by use of appropriate cost indices. The model selects the most economical decision for each firm from among four allowed alternatives:

(1) Send all wastewater to the group treatment facility (GTF).

(2) Send all cyanide-bearing wastewater to the GTF; treat other flows in-house and send dilute sludge to the GTF.

(3) Treat all flows in-house; send dilute sludge to the GTF.

(4) Perform all treatment processes, including sludge dewatering, at the individual plant.

Treatment processes that were considered are conventional cyanide oxidation, physical/chemical treatment (neutralization, precipitation, flocculation, clarification and thickening), and dewatering by filter press or vacuum filter. Dewatering to 20-30 percent solids content is considered essential whether performed in-house or at the GTF, since future disposal regulations will not allow dilute sludges to be placed in landfill, and since volume minimization is required to minimize transportation cost.

Plants which decide to ship wastewater to the GTF were required by the analysis to install sufficient 18,925-liter (5,000-gallon) tanks to hold separately 1 day's production of cyanide and noncyanide wastewater. The savings to each plant resulting from installation of countercurrent rinse at rinse stations not presently so equipped (if there is room) was computed. If such savings were positive, the plant was charged with the cost of such investment and installation, and the appropriate waste stream flows were reduced accordingly.

Transportation to the group treatment facility was assumed initially to be by 18,925-liter (5000-gallon) tank truck. The cost of shipping 18,925 liters (5000 gallons) by truck to the GTF was varied from $20.00 to $40.00, as noted earlier. (A typical charge for wastewater hauling is $40 per hour.) The interest rate on borrowed funds was varied from 6 percent to 18 percent. Each plant was assumed to require a 20 percent return on investment before committing capital to in-house treatment technology. That is, a plant is considered to ship its wastes to the GTF unless by constructing in-house treatment facilities it can realize a savings providing a return on invested capital of at least 20 percent.

Electric utility costs, a component of operating costs, were calculated by using the $.07 per kilowatt hour rate prevailing in the Providence area. In addition, operating labor, maintenance, and chemical costs were computed for each process. The capital cost of the group treatment facility is computed as the sum of the investment in each treatment process, multiplied by a factor of 1.65 which accounts for ancillary costs of GTF construction.[9] These costs include site work, excavation, shelter, laboratory, electrical installation, controls, piping, etc., in addition to such nonconstruction costs as A/E fees, legal fees, and contingency.

Such a factor was not applied to the cost of treatment processes installed within an existing plant, since it was assumed that necessary shelter, utilities, etc., already exist.

Table 3 shows the values of the financial parameters and the group treatment facility constants used in the analysis.

Results of Analysis

The calculated annual operating results for the region, consisting of the 10 participating firms, are summarized in Table 4. The annualized investment costs shown there represent the amortization of the initial capital investment at 12 percent over 15 years. Table 4 shows that, although the total waste hauling charges in the park for a year come to $124,540 (this total includes amortized in-plant storage costs as well),

TABLE 3. HUNTINGTON INDUSTRIAL PARK GROUP
TREATMENT ANALYSIS PARAMETER VALUES

FINANCIAL DATA	
Interest Rates and Equipment Life	
Interest Rate	12 percent
Return on Investment	20 percent
Equipment Life	15 years
Transportation and Power Costs	
Transportation Cost	$ 30.00 ($/5000 gallon)
Cost of Electrical Power	0.07 ($/KWH)
Cost Indexes	
CEman Cost Index	198.00
Chemical Plant Cost Index	246.90
Chemical Wholesale Price Index	287.20
GROUP TREATMENT FACILITY	
Identification	
Region Name	Providence
x Location	0.00 (miles)
y Location	0.00 (miles)
Number of Plants	10
Number of Routes	1
Operational Time	
Hours of Operation	16 (hours/day)
Days of Operation	300 (days/year)
Processes Considered	
Chromium Reduction	
Cyanide Oxidation	
Physical/Chemical Treatment	
Sludge Dewatering	
Storage Capacity	

TABLE 4. REGIONAL SUMMARY - HUNTINGTON INDUSTRIAL PARK

Hauling Cost = $30/5000 gallons Interest Rate = 12 percent

	Total Plant Investment (Annualized)	Total Plant Operating Costs	Total Plant Chemical Costs	Total Plant Costs	Total Transport Costs	Total GIF Fees	Total Annual Regional Costs
W/O GIF	$180,639	$183,489	$29,730.4	$393,858	$ 0.00	$ 0.00	$393,858
With GIF	31,704.4	29,147.1	4,303.41	65,154.8	124,540	84,428.8	274,123
Savings	$148,935	$154,342	$25,427.0	$328,704	-$124,540	-$84,428.8	$119,735

an overall annual savings of $119,735 is realized when compared to the costs of treatment without the existence of a GTF.

Figures 7 and 8 show the effect which the financing cost and the transportation charge have on the overall savings achieved. (It has been assumed that the same cost of money applies to financing of individual plant treatment construction and to construction of the group treatment facility.) Figure 7 shows that the annual savings increase rapidly as the interest rate increases. This is because the greater the cost of financing, the more significant the economy of scale factor becomes. Of course, the cost of servicing the debt increases as financing charges increase, but the savings make group treatment even more attractive as interest rates rise.

Figure 8 shows the same information plotted as annual savings versus the transportation charge. As the cost of hauling each 18,925 liters (5000 gallons) of wastewater from each plant to the GTF doubles from $20 to $40, the savings decrease by an amount between 12 and 20 percent depending on the interest rate. So it is advisable that the GTF subscribers take care to find the most efficient hauling means available.

The capacity of each treatment process at the GTF required to service the needs of the members is shown in Table 5. Since there is virtually no chromium in the wastewater of the participating plants, no provision for hexavalent chromium treatment is made. The total flow to the GTF is found to be little over 75,000 liters (20,000 gallons per day). This is substantially less than the total present wastewater flow of 1,135,500 liters per day (300,000 gallons per day) from the 10 plants. This is because: (1) the model found that all plants would find it cost-effective to reduce flow by installing counter-current rinses and/or still rinses at rinse stations where that is possible, and (2) two plants, having some of the largest flows, elected (based on the analysis) not to send all of their raw wastewater to the GTF.

Table 5 also shows a summary of all costs asssociated with operating each treatment process at the GTF, including the amortized investment cost. A fee for use of each process is then established (break-even operation for the GTF is assumed here), so that each participant is charged based on the volume of wastes which he sends to each process.

Table 6 lists each plant by code and shows the option chosen by each plant and the flows to each GTF process from each plant. Plant No. 1 found transportation of the raw wastewater to be so expensive that it determined its most cost-effective solution was to provide in-plant treatment through the clarification step and to send only the dilute sludge to the GTF.

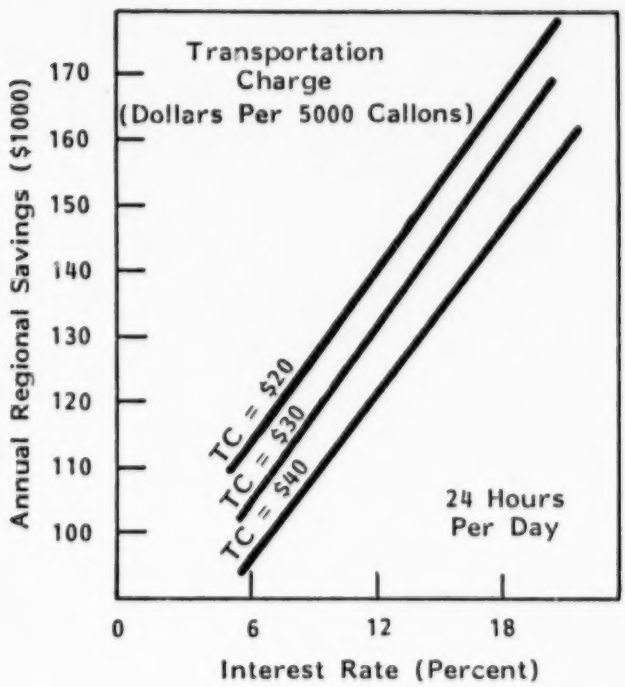

Figure 7. Regional savings versus cost of financing.

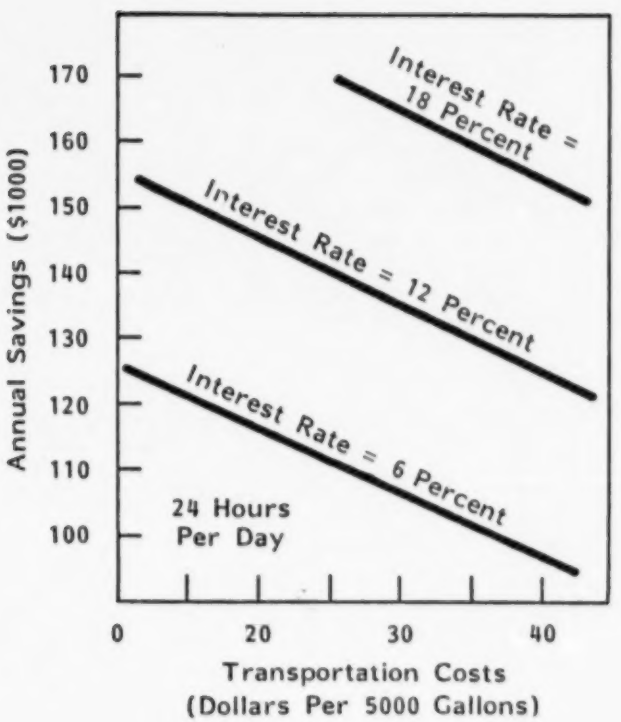

Figure 8. Savings versus transportation charge.

TABLE 5. GROUP TREATMENT FACILITY CONFIGURATION - PROCESS AND FEE STRUCTURE

Process	Required Capacity	Annualized Investment	Operating Costs	Chemical Costs	Total Costs	Fee Rate
1 - Chromium Reduction	0.0 gal/day	$ 0.0	$ 0.0	$ 0.0	$ 0.0	$0.0 $/gal
2 - Cyanide Oxidation	15,642.2 gal/day	5,751.7	5,776.0	26,051.9	37,579.6	0.0080 $/gal
3 - Phys/Chem Treatment	21,319.9 gal/day	17,973.9	10,008.9	3,694.3	31,677.1	0.0050 $/gal
4 - Sludge Dewatering	65.2 lb/day	6,287.6	2,323.6	0.0	8,611.2	0.4402 $/lb
5 - Storage	21,319.9 gal/day	6,560.9	0.0	0.0	6,560.9	0.0010 $/gal

TABLE 6. OPTION CHOSEN BY EACH PLANT AND FLOWS TO EACH PROCESS AT THE GROUP TREATMENT FACILITY

Plant No.	Option Chosen -Wastestream to GTF-	Average Daily Flows to Group Treatment Facility		
		Cn Oxidation Gal	Phys/Chem Trtm Gal	Sludge Dewatering lb
1	3- only sludge	0.0	0.0	2.2
2	1- all flow	7797.5	9493.6	21.1
3	1- all flow	549.5	1693.0	10.2
4	1- all flow	639.0	818.5	1.7
5	2- Cn and sludge	646.5	646.5	8.9
6	1- all flow	904.2	2562.0	6.8
7	1- all flow	1476.8	2216.1	0.5
8	1- all flow	970.5	1389.1	4.1
9	1- all flow	1235.0	1553.3	1.6
10	1- all flow	6316.0	7126.7	27.5

Certainly that option choice could be changed based on segregation of certain running rinses which do not require treatment and the accomplishment of more flow reduction than the model assumptions allowed. Plant No. 5, with a small cyanide stream flow but with a large acid/alkali flow, chose not to treat cyanide in-plant but to send the cyanide wastes to the GTF. Nevertheless, the large acid/alkali flow was found to be more economically treated in house, sending only the dilute sludge to the GTF. Again, other waste concentration measures could change that solution.

Table 7 shows a comparison of the capital investment in treatment equipment required with and without the group treatment facility. The capital cost of the GTF itself is only 23 percent of the total in-plant investment required without group treatment. This ratio corresponds closely to the estimate shown in Figure 1 (taken from Reference 3) for 10 subscribing plants. Table 8 shows the capital cost breakdown for the group treatment facility. This is the amount which would have to be financed jointly by the participants. If the GTF were fully financed over 15 years at 12 percent as assumed here, the fee structure shown in Table 5 would enable the GTF to service its debt. In addition, each plant would have to bear its in-plant costs of stream segregation, storage provision, and wastewater flow reduction (included as part of transportation costs in Table 2). The two plants which elected to install some in-plant treatment (under this set of assumptions) would have that capital cost in addition. These in-plant costs for each participant are shown in Table 9.

Appendix B presents the detailed computer input data for each plant, showing the flow and pollutant concentrations for each wastestream. Concentrations shown in Appendix B as provided to the model differ in general from the rinsewater analyses given in Appendix A because corrections for batch dumps and for full production have been incorporated.

Piping of Wastewater to the GTF

While truck hauling of wastes was assumed in the previous analysis, the possibility of constructing an industrial wastewater sewer system within the park was considered as described in Section 3. A double pipe system, designed to carry cyanide and noncyanide wastes separately, was evaluated. The breakdown of the estimated cost was shown in Table 2.

With installation of such a system for collection of wastewater, the total costs of construction are as shown below:

TABLE 7. INVESTMENT REQUIRED WITH AND WITHOUT GROUP TREATMENT

In-plant Investment Without Group Treatment		$1,229,864
In-plant Investment With Group Treatment	$215,673	
Capital Cost of the GTF	287,991	503,664
Capital Savings		$ 726,200

TABLE 8. GROUP TREATMENT FACILITY CAPITAL COST BREAKDOWN

Cyanide Oxidation		$ 23,059
Physical/Chemical Treatment		72,496
Sludge Dewatering		42,772
Storage		36,066
Laboratory, Shelter, etc.		113,598
	Total	$287,991

TABLE 9. IN-PLANT CAPITAL INVESTMENT REQUIRED BY EACH PARTICIPANT

Plant	Rinse Reduction	Storage	In-plant Treatment	Total
1	$ 866	$ -	$ 132,074	$132,940
2	2,598	13,541	-	16,139
3	9,526	13,541	-	23,067
4	6,062	13,541	-	19,603
5	6,928	6,771	83,599	97,298
6*	9,526	13,541	-	23,067
7	3,464	13,541	-	17,005
8	5,196	13,541	-	18,737
9*	866	13,541	-	14,407
10	19,052	13,541	-	32,593

*Plant was represented as mean of other plants.

Cost of the GTF Construction	$288,000
Cost of the Sewer Collection System	344,000
	$632,000
Allowance for Additional GTF Flow	150,000
	$782,000

Choice of this mode of wastewater collection would eliminate most of the annual hauling expense (storage and truck transport) shown in Table 4 although the portion related to in-plant flow reduction would still have to be borne. Amortizing the cost of sewer system installation over the same 15 years at 12 percent results in an annual charge of $50,568, certainly comparing favorably with the total annual transportation charges shown in Table 4. But it must be emphasized that, even if wastes were to be piped to the GTF, maximum waste concentration through flow reduction would still be required in order to keep the GTF treatment process costs close to the estimate shown.

Financing and Management Alternatives

The group treatment concept, as the term has been used here, requires that the ownership and/or management be shared by some or all of the companies with wastes to be treated. A group of firms, such as those at Huntington Industrial Park, has several alternatives for financing of the proposed facility. Among these are conventional bank loans, industrial revenue bond financing, and industrial revenue bond financing with special Small Business Administration (SBA) repayment guarantee.

The proposed facility will apparently be eligible for either of two alternative tax treatments.[10] The first alternative involves depreciation of the useful life of the pollution control equipment by any IRS-approved method, coupled with the full 10 percent investment tax credit. Under the second alternative, rapid amortization of pollution control facilities through Section 169 of the Internal Revenue Code may be chosen. If the facility qualifies, the investment cost may be written off over a 60-month period, but only one-half of the investment tax credit, applicable to the year of purchase, may be taken.

Should an incorporated GTF venture show an operating loss, the ability of any of the participating firms to apply that loss against its own business profits may be severely limited, since only a firm owning at least 80 percent of the treatment facility could consolidate the financial statements. Such tax implications of group treatment require detailed investigation for each proposed arrangement. The financial summaries included in this paper have omitted income tax considerations.

Conventional bank loan financing of the group treatment facility is a possibility. The individual companies involved in the ownership may each qualify for a portion of the loan. The

loan could be made either directly to the firms involved or to a corporation formed by the firms to own and operate the facility. In either case, the bank would look to the assets and creditworthiness of the individual firms.

If applications for a conventional loan result in a turndown, it is possible to qualify for an SBA "economic injury loan" under the Pollution Control Loan Program. Rates are at below-market interest. Roughly one-quarter of such loans made through last year were to electroplaters.[10]

Perhaps the most attractive financing for such a venture is through the issuance of tax-exempt industrial revenue bonds. Such bonds are issued by a public entity. Were such bonds to be issued to finance the proposed Huntington Industrial Park group treatment facility, the likely issuer would be the Rhode Island Department of Economic Development.

Until recently, such bond issues were possible only for large enterprises in strong financial position, since the investor must rely on the credit of the firm for repayment. But, in June 1976, the SBA received authority to guarantee loans to eligible small businesses for the acquisition of pollution control facilities. This SBA guarantee may be for an amount of up to $5 million, the full amount of principal and interest, and may run for a term of up to 25 years. The funds raised by the public entity (Rhode Island Department of Economic Development, in this case) would be loaned to the participating firms. The repayment of these funds by the firms would then be guaranteed by the SBA. To qualify for the loan guarantee, each firm participating in the ownership arrangement must meet the definition of a small business (for electroplaters, one definition is a firm with fewer than 250 employees) and must have been in business for at least 5 years, at least 3 of them profitable. In addition, the participating companies must be financially able to service the debt. When tax exempt bond financing is combined with the SBA guarantee feature, the resulting AAA rating provides small businesses with the most favorable financing rates possible, rates heretofore available only to the largest concerns.

Preliminary discussions with a potential underwriter have been held relative to the financing of the Huntington Industrial Park group treatment facility. In practice, such an underwriter, in conjunction with local bond counsel and the issuer, put together the financing package. While joint treatment facilities for electroplaters have not yet been financed under this program, similar joint treatment ventures have been or are being financed under the program for a group of cheese processors, a group of potato cooperatives, and others. A practical limitation may be the fact that when more than three or four firms are involved in the ownership, the administrative costs of

putting together the package may become excessive. Because fees for bond counsel, the SBA guarantee, underwriting costs, etc., must come out of the loan proceeds, the advantages of this approach cannot be realized when the amount to be financed is less than $100,000. Were one to four of the firms in Huntington Industrial Park to propose to own and manage the group treatment facility under this SBA guarantee program, the SBA would be interested in assuring that firm contractual arrangements give those firms not participating in ownership a guarantee of future access and fair charges.

Platers interested in investigating the SBA Pollution Control Financing Guarantee Program should contact the SBA, Pollution Control Financing Division, Office of Special Guarantees, 1815 North Lynn Street, Magazine Bldg., Rosslyn, Virginia 22209, (703) 235-2900.

Appendix C of this report provides Application Guidelines and copies of required forms.

REFERENCES

1. Federal Register, 44(175):52590-52629, September 7, 1979, Effluent Guidelines and Standards; Electroplating Point Source Category; Pretreatment Standards for Existing Sources.

2. Craig, Jr., Alfred B., "EPA's Centralized Treatment Program," paper presented at the Second Conference on Advanced Pollution Control for the Metal Finishing Industry, EPA-600/8-79-014, NTIS No. PB 297-453, February 1979.

3. Minor, Paul S., and Roger J. Batstone, "Applicability of the Federal Republic of Germany's Centralized Waste Treatment Approach in the United States," paper presented at the Second Conference on Advanced Pollution Control for the Metal Finishing Industry, EPA-600/8-79-014, NTIS No. PB 297-453, February 1979.

4. Saito, M., and A. Nakamura, "Resource Recovery, Water Saving, and Waste Treatment in Chuo Electroplating Industrial Park," April 1978.

5. "Group Treatment of Multicompany Plating Wastes (The Taunton Silver Project)," EPA-600/2-79-102, EPA ORD, July 1979.

6. "Plating City: Feasibility Study of Electroplating Industry Consolidation," report prepared for Brooklyn Economic Development Corporation, Gibbs & Hill, Inc., November 1979.

7. Development Document for Proposed Existing Source Pretreatment Standards for the Electroplating Point Source Category, EPA 440/1-79/085, February 1978.

8. Economics of Wastewater Treatment Alternatives for the Electroplating Industry, EPA 625/5-79-016, June 1979.

9. Construction Costs for Municipal Wastewater Treatment Plants, 1973 - 1977, U.S. EPA, Office of Water Program Operations, January 1978.

10. Sacks, Sheldon, "Federal Financial Assistance for Pollution Abatement," paper presented at the Second Conference on Advanced Pollution Control for the Metal Finishing Industry, EPA-600/8-79-014, NTIS No. PB 297-453, February 1979.

APPENDIX A

ANALYTICAL RESULTS OF PLANT SURVEY
(Huntington Industrial Park)

CENTEC ANALYTICAL SERVICES, INC.
A SUBSIDIARY OF CENTEC, INC.
OFFICES IN RESTON, VA • FORT LAUDERDALE, FLA

P. O. BOX 956
2160 INDUSTRIAL DRIVE
SALEM, VIRGINIA 24153
(703) 387-3995

— ANALYTICAL RESULTS REPORT —

Mr. John Kresky
CENTEC Corporation
11800 Sunrise Valley Drive
Reston, VA 22091

Re: Plant #1
CAS Commission No. 2907-02

REPORT DATE/NUMBER: 11 March 1980/1

TYPE OF SAMPLES: Industrial Wastewater

SAMPLES COLLECTED BY: CAS/ISCO

ANALYSIS FOR: Cyanide, Total (CN-T) Cyanide, Amemable to Chlorination (CN-A), Cadmium (Cd), Chromium (Cr), Copper (Cu), Iron (Fe), Nickel (Ni), Lead (Pb). Zinc (Zn), Chromium (+6), Silver (Ag).

METHOD OF ANALYSIS: Re: Federal Register, Vol. 41, No. 232. 1 Dec. 1976

Results on Page Two.

If you have any questions or comments concerning this report, please do not hesitate to contact us.

Prepared by:

CENTEC ANALYTICAL SERVICES

Ted L. Robinson
Chemist

CAS No.	Description	Date Received	Ag (mg/l)	Cr+6 (mg/l)	CN-T (mg/l)	CN-A (mg/l)	Cd (mg/l)	Cr (mg/l)	Cu (mg/l)	Fe (mg/l)	Ni (mg/l)	Pb (mg/l)	Zn (mg/l)
9881	CN Bath Comp. 2/11/80	2/13/80; 1515			20.4	18.1							
9883	CN Bath Comp. 2/11/80	2/13/80; 1515		<0.10			0.03	<0.05	6.85	0.42	0.25	0.008	0.82
9878	Final Effluent 2/11/80	2/13/80; 1515	<0.01	<0.10			<0.01	0.05	0.68	0.07	0.95	<0.001	0.06
9879	Final Effluent 2/11/80	2/13/80· 1515			2.9	2.2							
9928	Electro-Clean 2/13/80;1600	2/15/80; 1330		<0.10			0.13	0.20	4.00	1.73	1.72	1.00	1.15
9929	Ultra-Sonic 2/13/80;1600	1/15/80· 1330		<0.10			0.92	0.20	10.2	1.54	6.35	1.00	1.15
9930	Acid Rinsing 2/13/80;1600	1/15/80; 1330		<0.10			0.21	0.06	9.95	22.5	1.90	0.50	1.75
9942	Grab 2/15/80;1530	1/17/80; 1830		<0.10	3520	1120*	<0.01	0.27	0.05	855	0.35	0.008	0.10

* Point of chlorination was not actually reached due to nature of sample.

Prepared by:

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Ted L. Robinson, Chemist

TLR /lsm

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— ANALYTICAL RESULTS REPORT —

Mr. John Kresky
CENTEC Corporation
11800 Sunrise Valley Drive
Reston, VA 22091

Re: Plant #2
CAS Commission No. 2907-02

REPORT DATE/NUMBER: 11 March 1980/2

TYPE OF SAMPLES: Industrial Wastewater

SAMPLES COLLECTED BY: ISCO/CAS

ANALYSIS FOR: Cyanide, Total (CN-T), Cyanide Amemable to Chlorination (CN-A), Cadmium (Cd), Chromium (Cr) Copper (Cu) Iron (Fe), Nickel (Ni), Lead (Pb), Zinc (Zn) Chromium +6 Silver (Ag)

METHOD OF ANALYSIS: Re: Federal Register, Vol. 41, No. 232, 1 Dec. 1976

CAS No.	Description	Date Received	CN-T (mg/l)	CN-A (mg/l)	Cd (mg/l)	Cr (mg/l)	Cu (mg/l)
9938	Final Effluent 2/15/80	2/17/80: 1830	2.0	<0.1	<0.01	<0.05	4.48
9939	CN Overflow Rinse 2/15/80	2/17/80: 1830	4.4	1.8	<0.01	<0.05	0.09

CAS No.	Description	Fe (mg/l)	Ni (mg/l)	Pb (mg/l)	Zn (mg/l)	Cr+6, (mg/l)	(m
9938	Final Effluent	0.38	2.18	0.002	0.84	<0.10	0
9939	CN Overflow Rinse	<0.10	<0.10	0.002	0.02	<0.10	

Prepared by:

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— ANALYTICAL RESULTS REPORT —

Mr. John Kresky
CENTEC Corporation
11800 Sunrise Valley Drive
Reston, VA 22091

Re: Plant #3
CAS Commission No. 2907-02

REPORT DATE/NUMBER: 11 March 1980/3

TYPE OF SAMPLES: Industrial Wastewater

SAMPLES COLLECTED BY: ISCO

ANALYSIS FOR: Cyanide, Total (CN-T), Cyanide , Amemable to Chlorination (CN-A), Cadmium (Cd). Chromium (Cr). Copper (Cu), Iron (Fe), Nickel (Ni), Lead (Pb), Zinc (Zn), Chromium +6, Silver (Ag)

METHOD OF ANALYSIS: Re: Federal Register, Vol. 41, No. 232, 1 Dec. 1976

CAS No.	Description	Date Received	CN-T (mg/l)	CN-A (mg/l)	Cd (mg/l)	Cr (mg/l)	Cu (mg/l)
9926	Final Effluent 2/13/80	2/15/80; 1330	3.0	2.8	<0.01	<0.05	0.08
9927	CN Rinsing Bath Comp. 2/13/80	2/15/80;	21.6	21.4	<0.01	<0.05	0.04

CAS No.	Description	Fe (mg/l)	Ni (mg/l)	Pb (mg/l)	Zn (mg/l)	Cr+6 (mg/l)	Ag (mg/l)
9926	Final Effluent	<0.10	7.42	0.001	<0.01	<0.10	0.20
9927	CN Rinsing Bath Comp.	<0.10	0.10	<0.001	<0.01	<0.10	

Prepared by:

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Ted L. Robsinson, Chemist

SAMPLING AND ANALYSIS RELATING TO: WASTEWATER/GROUNDWATER • WATER/DRINKING WATER • BIOLOGICAL MONITORING • OSHA COMPLIANCE • AIR QUALITY • TOXIC SUBSTANCES

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— ANALYTICAL RESULTS REPORT —

Mr. John Kresky
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11800 Sunrise Valley Drive
Reston, VA 22091

Re: Plant #4
CAS Commission No. 2907-02

REPORT DATE/NUMBER: 11 March 1980/4

TYPE OF SAMPLES: Industrial Wastewater

SAMPLES COLLECTED BY: CAS/ISCO

ANALYSIS FOR: Cyanide, Total (CN-T), Cyanide, Amemable to Chlorination (CN-A), Cadmium (Cd), Chromium (Cr), Copper (Cu), Iron (Fe), Nickel (Ni), Lead (Pb), Zinc (Zn), Chromium +6 Silver (Ag)

METHOD OF ANALYSIS: Re: Federal Register, Vol. 41, No. 232, 1 Dec. 1976

CAS No.	Description	Date Received	CN-T (mg/l)	CN-A (mg/l)	Cd (mg/l)	Cr (mg/l)	Cu (mg/l
9884	CN Rinse Bath 2/12/80	2/13/80; 1530	8.6	8.6	<0.01	<0.05	0.06
9985	Final Effluent 2/12/80	2/13/80; 1530	3.9	3.9	<0.01	<0.05	0.45

CAS No.	Description	Fe (mg/l)	Ni (mg/l)	Pb (mg/l)	Zn (mg/l)	Cr+6 (mg/l)	Ag (mg/l
9884	CN Rinse Bath	<0.10	<0.10	<0.001	<0.01	<0.10	
9885	Final Effluent	<0.10	1.10	0.004	0.17	<0.10	0.13

Prepared by:

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SAMPLING AND ANALYSIS RELATING TO: WASTEWATER/TREATABILITY • WATER/DRINKING WATER • BIOLOGICAL MONITORING • OSHA COMPLIANCE • AIR QUALITY • TOXIC SUBSTANCES

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— ANALYTICAL RESULTS REPORT —

Mr. John Kresky
CENTEC Corporation
11800 Sunrise Valley Drive
Reston, VA 22091

Re: Plant #5
CAS Commission No. 2907-02

REPORT DATE/NUMBER: 11 March 1980/5

TYPE OF SAMPLES: Industrial Wastewater

SAMPLES COLLECTED BY: CAS/ISCO

ANALYSIS FOR: Cyanide, Total (CN-T), Cyanide, Amemable to Chlorination (CN-A), Cadmium (Cd), Chromium (Cr), Copper (Cu), Iron (Fe), Nickel (Ni), Lead (Pb), Zinc (Zn), Chromium +6 Silver (Ag)

METHOD OF ANALYSIS: Re: Federal Register, Vol. 41, No. 232, 1 Dec. 1976

CAS No.	Description	Date Received	CN-T (mg/l)	CN-A (mg/l)	Cd (mg/l)	Cr (mg/l)	Cu (mg/l)
9890	Final Effluent 2/12/80	2/13/80; 1530	0.10	0.07	<0.01	<0.05	0.11
9891	CN Rinse Bath 2/12/80	2/13/80; 1530	1.6	1.6	<0.01	<0.05	0.33

CAS No.	Description	Fe (mg/l)	Ni (mg/l)	Pb (mg/l)	Zn (mg/l)	Cr+6 (mg/l)	Ag (mg/l)
9890	Final Effluent	<0.10	0.95	0.006	0.02	<0.10	<0.01
9891	CN Rinse Bath	<0.10	0.10	0.002	0.16	<0.10	

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— ANALYTICAL RESULTS REPORT —

Mr. John Kresky
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Re: Plant #7
CAS Commission No. 2907-02

REPORT DATE/NUMBER: 11 March 1980/6

TYPE OF SAMPLES: Industrial Wastewater

SAMPLES COLLECTED BY: CENTEC/ISCO

ANALYSIS FOR: Cyanide, Total (CN-T), Cyanide, Amemable to Chlorination (CN-A), Cadmium (Cd), Chromium (Cr), Copper (Cu), Iron (Fe), Nickel (Ni), Lead (Pb), Zinc (Zn), Chromium +6, Silver (Ag)

METHOD OF ANALYSIS: Re: Federal Register, Vol. 41, No. 232, 1 Dec. 1976

CAS No.	Description	Date Received	CN-T (mg/l)	CN-A (mg/l)	Cd (mg/l)	Cr (mg/l)	Cu (mg/l
9922	Final Effluent	2/15/80; 2/14/80 1330	0.08	0.02	<0.01	<0.05	0.05
9923	CN Rinse Bath	2/15/80; 2/14/80 1330	0.05	≥0.04	<0.01	<0.05	<0.01

CAS No.	Description	Fe (mg/l)	Ni (mg/l)	Pb (mg/l)	Zn (mg/l)	Cr+6 (mg/l)	Ag (mg/l
9922	Final Effluent	<0.10	1.85	0.003	0.03	<0.10	<0.01
9923	CN Rinse Bath	<0.10	0.10	0.002	0.07	<0.10	

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— ANALYTICAL RESULTS REPORT —

Mr. John Kresky
CENTEC Corporation
11800 Sunrise Valley Drive
Reston, VA 22091

Re: Plant #8
CAS Commission No. 2907-02

REPORT DATE/NUMBER: 11 March 1980/7

TYPE OF SAMPLES: Industrial Wastewater

SAMPLES COLLECTED BY: ISCO

ANALYSIS FOR: Cyanide, Total (CN-T), Cyanide, Amemable to Chlorination (CN-A), Cadmium (Cd), Chromium (Cr), Copper (Cu), Iron (Fe), Nickel (Ni), Lead (Pb), Chromium +6, Zinc (Zn), Silver (Ag)

METHOD OF ANALYSIS: Re: Federal Register, Vol. 41, No. 232, 1 Dec. 1976

CAS No.	Description	Date Received	CN-T (mg/l)	CN-A (mg/l)	Cd (mg/l)	Cr (mg/l)	Cu (mg/l)
9940	Final Effluent 2/15/80;1100	2/17/80; 1830	2.2	0.73	<0.01	<0.05	2.61
9941	CN Overflow 2/15/80;	2/17/80; 1830	2.5	0.93	<0.01	<0.05	1.59

CAS No.	Description	Fe (mg/l)	Ni (mg/l)	Pb (mg/l)	Zn (mg/l)	Cr+6 (mg/l)	Ag (mg/l)
9940	Final Effluent	0.10	1.05	0.004	0.37	<0.10	<0.01
9941	CN Overflow	0.12	<0.10	<0.001	0.02	<0.10	

Prepared by:

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SAMPLING AND ANALYSIS RELATING TO: WASTEWATER/TREATABILITY • WATER/DRINKING WATER • BIOLOGICAL MONITORING • OSHA COMPLIANCE • AIR QUALITY • TOXIC SUBSTANCES

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— ANALYTICAL RESULTS REPORT —

Mr. John Kresky
CENTEC Corporation
11800 Sunrise Valley Drive
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Re: Plant #10
CAS Commission No. 2907-02

REPORT DATE/NUMBER: 11 March 1980/8

TYPE OF SAMPLES:. Industrial Wastewater

SAMPLES COLLECTED BY: ISCO

ANALYSIS FOR: Cyanide, Total (CN-T), Cyanide, Amemable to Chlorination (CN-A), Cadmium (Cd), Chromium (Cr), Copper (Cu), Iron (Fe), Nickel (Ni), Lead (Pb), Chromium +6, Zinc (Zn) Silver (Ag)

METHOD OF ANALYSIS: Re: Federal Register, Vol. 41, No. 232, 1 Dec. 1976

CAS No.	Description	Date Received	CN-T (mg/l)	CN-A (mg/l)	Cd (mg/l)	Cr (mg/l)	Cu (mg/l
9924	Final Effluent 2/14/80	2/15/80; 1330	10.7	7.7	<0.01	0.69	4.92
9925	CN Rinse Bath 2/14/80	2/15/80; 1330	56.6	52.2	<0.01	<0.05	16.8

CAS No.	Description	Fe (mg/l)	Ni (mg/l)	Pb (mg/l)	Zn (mg/l)	Cr+6 (mg/l)	Ag (mg/l
9924	Final Effluent	1.10	6.90	0.008	1.50	<0.10	<0.01
9925	CN Rinse Bath	0.07	6.45	<0.001	5.20	<0.10	

Prepared by:

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APPENDIX B

ANALYSIS OF TREATMENT OPTIONS

(Huntington Industrial Park)

PLANT IDENTIFICATION		
#1: Plant number	1	
PLANT DESCRIPTION		
#1: Plant code	1	
#1: Hours of operation	8	(hours/day)
#1: Days of operation	242	(days/year)
#1: Existing plant processes	0	(0-4)
#1: X location	0.00	(miles)
#1: Y location	1.00	(miles)
#1: Route	1	
CYANIDE STREAM		
#1: Stream flow	31715	(gal/day)
#1: Tri chromium	0.00	(ppm)
#1: Hex chromium	0.00	(ppm)
#1: Cyanide	9.57	(ppm)
#1: Zinc	0.00	(ppm)
#1: Iron	0.00	(ppm)
#1: Nickel	0.00	(ppm)
#1: Copper	0.00	(ppm)
#1: Cadmium	0.00	(ppm)
#1: Lead	0.00	(ppm)
#1: Number of rinse stations	7	
#1: Number with flow reduction	6	
#1: Number which could have reduction	1	

PLANT #1 (continued)

ACID/ALKALI STREAM

#1: Stream flow	32340	(gal/day)
#1: Tri chromium	0.14	(ppm)
#1: Hex chromium	0.00	(ppm)
#1: Cyanide	0.00	(ppm)
#1: Zinc	0.16	(ppm)
#1: Iron	0.58	(ppm)
#1: Nickel	2.52	(ppm)
#1: Copper	1.84	(ppm)
#1: Cadmium	0.00	(ppm)
#1: Lead	0.01	(ppm)
#1: Number of rinse stations	10	
#1: Number with flow reduction	6	
#1: Number which could have reduction	0	

PLANT IDENTIFICATION

#2: Plant number	2	

PLANT DESCRIPTION

#2: Plant code	2	
#2: Hours of operation	8	(hours/day)
#2: Days of operation	243	(days/year)
#2: Existing plant processes	0	(0-4)
#2: X location	0.00	(miles)
#2: Y location	1.00	(miles)
#2: Route	1	

CYANIDE STREAM

#2: Stream flow	11228	(gal/day)
#2: Tri chromium	0.00	(ppm)
#2: Hex chromium	0.00	(ppm)
#2: Cyanide	24.20	(ppm)
#2: Zinc	0.00	(ppm)
#2: Iron	0.00	(ppm)
#2: Nickel	0.00	(ppm)
#2: Copper	0.00	(ppm)
#2: Cadmium	0.00	(ppm)
#2: Lead	0.00	(ppm)
#2: Number of rinse stations	8	
#2: Number with flow reduction	5	
#2: Number which could have reduction	1	

ACID/ALKALI STREAM

#2: Stream flow	13472	(gal/day)
#2: Tri chromium	0.00	(ppm)
#2: Hex chromium	0.00	(ppm)
#2: Cyanide	0.00	(ppm)
#2: Zinc	13.30	(ppm)
#2: Iron	7.88	(ppm)
#2: Nickel	31.90	(ppm)
#2: Copper	68.50	(ppm)
#2: Cadmium	0.00	(ppm)
#2: Lead	0.17	(ppm)
#2: Number of rinse stations	10	
#2: Number with flow reduction	8	
#2: Number which could have reduction	2	

PLANT IDENTIFICATION

#3: Plant number	3	

PLANT DESCRIPTION

#3: Plant code	3	
#3: Hours of operation	16	(hours/day)
#3: Days of operation	286	(days/year)
#3: Existing plant processes	0	(0-4)
#3: X location	0.00	(miles)
#3: Y location	1.00	(miles)
#3: Route	1	

CYANIDE STREAM

#3: Stream flow	6588	(gal/day)
#3: Tri chromium	0.00	(ppm)
#3: Hex chromium	0.00	(ppm)
#3: Cyanide	68.60	(ppm)
#3: Zinc	0.00	(ppm)
#3: Iron	0.00	(ppm)
#3: Nickel	0.00	(ppm)
#3: Copper	0.00	(ppm)
#3: Cadmium	0.00	(ppm)
#3: Lead	0.00	(ppm)
#3: Number of rinse stations	8	
#3: Number with flow reduction	5	
#3: Number which could have reduction	3	

ACID/ALKALI STREAM

#3: Stream flow	40838.0	(gal/day)
#3: Tri chromium	0.00	(ppm)
#3: Hex chromium	0.00	(ppm)
#3: Cyanide	0.00	(ppm)
#3: Zinc	0.30	(ppm)
#3: Iron	0.00	(ppm)
#3: Nickel	16.70	(ppm)
#3: Copper	2.06	(ppm)
#3: Cadmium	0.00	(ppm)
#3: Lead	0.02	(ppm)
#3: Number of rinse stations	8	
#3: Number with flow reduction	0	
#3: Number which could have reduction	8	

PLANT IDENTIFICATION

#4: Plant number	4	

PLANT DESCRIPTION

#4: Plant code	4	
#4: Hours of operation	8	(hours/day)
#4: Days of operation	242	(days/year)
#4: Existing plant processes	0	(0-4)
#4: X location	0.00	(miles)
#4: Y location	1.00	(miles)
#4: Route	1	

CYANIDE STREAM

#4: Stream flow	5320	(gal/day)
#4: Tri chromium	0.00	(ppm)
#4: Hex chromium	0.00	(ppm)
#4: Cyanide	16.10	(ppm)
#4: Zinc	0.00	(ppm)
#4: Iron	0.00	(ppm)
#4: Nickel	0.00	(ppm)
#4: Copper	0.00	(ppm)
#4: Cadmium	0.00	(ppm)
#4: Lead	0.00	(ppm)
#4: Number of rinse stations	4	
#4: Number with flow reduction	3	
#4: Number which could have reduction	1	

ACID/ALKALI STREAM

#4: Stream flow	6411	(gal/day)
#4: Tri chromium	0.00	(ppm)
#4: Hex chromium	0.00	(ppm)
#4: Cyanide	0.00	(ppm)
#4: Zinc	3.29	(ppm)
#4: Iron	0.00	(ppm)
#4: Nickel	11.50	(ppm)
#4: Copper	5.66	(ppm)
#4: Cadmium	0.02	(ppm)
#4: Lead	0.23	(ppm)
#4: Number of rinse stations	6	
#4: Number with flow reduction	0	
#4: Number which could have reduction	6	

PLANT IDENTIFICATION

#5: Plant number	5	

PLANT DESCRIPTION

#5: Plant code	5	
#5: Hours of operation	8	(hours/day)
#5: Days of operation	240	(days/year)
#5: Existing plant processes	0	(0-4)
#5: X location	0.00	(miles)
#5: Y location	1.00	(miles)
#5: Route	1	

CYANIDE STREAM

#5: Stream flow	3804	(gal/day)
#5: Tri chromium	0.00	(ppm)
#5: Hex chromium	0.00	(ppm)
#5: Cyanide	19.90	(ppm)
#5: Zinc	0.00	(ppm)
#5: Iron	0.00	(ppm)
#5: Nickel	0.00	(ppm)
#5: Copper	0.00	(ppm)
#5: Cadmium	0.00	(ppm)
#5: Lead	0.00	(ppm)
#5: Number of rinse stations	6	
#5: Number with flow reduction	5	
#5: Number which could have reduction	1	

ACID/ALKALI STREAM

#5: Stream flow	57060.0	(gal/day)
#5: Tri chromium	0.00	(ppm)
#5: Hex chromium	0.00	(ppm)
#5: Cyanide	0.00	(ppm)
#5: Zinc	0.34	(ppm)
#5: Iron	0.00	(ppm)
#5: Nickel	10.24	(ppm)
#5: Copper	1.29	(ppm)
#5: Cadmium	0.00	(ppm)
#5: Lead	0.07	(ppm)
#5: Number of rinse stations	11	
#5: Number with flow reduction	2	
#5: Number which could have reduction	7	

PLANT IDENTIFICATION

#6: Plant number	6	

PLANT DESCRIPTION

#6: Plant code	6	
#6: Hours of operation	8	(hours/day)
#6: Days of operation	243	(days/year)
#6: Existing plant processes	0	(0-4)
#6: X location	1.00	(miles)
#6: Y location	0.00	(miles)
#6: Route	1	

CYANIDE STREAM

#6: Stream flow	5320	(gal/day)
#6: Tri chromium	0.00	(ppm)
#6: Hex chromium	0.00	(ppm)
#6: Cyanide	29.60	(ppm)
#6: Zinc	0.00	(ppm)
#6: Iron	0.00	(ppm)
#6: Nickel	0.00	(ppm)
#6: Copper	0.00	(ppm)
#6: Cadmium	0.00	(ppm)
#6: Lead	0.00	(ppm)
#6: Number of rinse stations	6	
#6: Number with flow reduction	5	
#6: Number which could have reduction	1	

ACID/ALKALI STREAM

#6: Stream flow	13472	(gal/day)
#6: Tri chromium	0.00	(ppm)
#6: Hex chromium	0.00	(ppm)
#6: Cyanide	0.00	(ppm)
#6: Zinc	3.71	(ppm)
#6: Iron	1.80	(ppm)
#6: Nickel	17.10	(ppm)
#6: Copper	16.30	(ppm)
#6: Cadmium	0.00	(ppm)
#6: Lead	0.08	(ppm)
#6: Number of rinse stations	14	
#6: Number with flow reduction	3	
#6: Number which could have reduction	10	

PLANT IDENTIFICATION

#7: Plant number	7	

PLANT DESCRIPTION

#7: Plant code	7	
#7: Hours of operation	8	(hours/day)
#7: Days of operation	250	(days/year)
#7: Existing plant processes	0	(0-4)
#7: X location	1.00	(miles)
#7: Y location	0.00	(miles)
#7: Route	1	

CYANIDE STREAM

#7: Stream flow	4000	(gal/day)
#7: Tri chromium	0.00	(ppm)
#7: Hex chromium	0.00	(ppm)
#7: Cyanide	0.39	(ppm)
#7: Zinc	0.00	(ppm)
#7: Iron	0.00	(ppm)
#7: Nickel	0.00	(ppm)
#7: Copper	0.00	(ppm)
#7: Cadmium	0.00	(ppm)
#7: Lead	0.00	(ppm)
#7: Number of rinse stations	5	
#7: Number with flow reduction	2	
#7: Number which could have reduction	2	

ACID/ALKALI STREAM

#7: Stream flow	2000	(gal/day)
#7: Tri chromium	0.00	(ppm)
#7: Hex chromium	0.00	(ppm)
#7: Cyanide	0.00	(ppm)
#7: Zinc	0.30	(ppm)
#7: Iron	0.00	(ppm)
#7: Nickel	18.51	(ppm)
#7: Copper	0.00	(ppm)
#7: Cadmium	0.00	(ppm)
#7: Lead	0.03	(ppm)
#7: Number of rinse stations	6	
#7: Number with flow reduction	3	
#7: Number which could have reduction	2	

PLANT IDENTIFICATION

#8: Plant number	8	

PLANT DESCRIPTION

#8: Plant code	8	
#8: Hours of operation	8	(hours/day)
#8: Days of operation	240	(days/year)
#8: Existing plant processes	0	(0-4)
#8: X location	1.00	(miles)
#8: Y location	0.00	(miles)
#8: Route	1	

CYANIDE STREAM

#8: Stream flow	5033	(gal/day)
#8: Tri chromium	0.00	(ppm)
#8: Hex chromium	0.00	(ppm)
#8: Cyanide	33.60	(ppm)
#8: Zinc	0.00	(ppm)
#8: Iron	0.00	(ppm)
#8: Nickel	0.00	(ppm)
#8: Copper	0.00	(ppm)
#8: Cadmium	0.00	(ppm)
#8: Lead	0.00	(ppm)
#8: Number of rinse stations	7	
#8: Number with flow reduction	6	
#8: Number which could have reduction	1	

ACID/ALKALI STREAM

#8: Stream flow	8493	(gal/day)
#8: Tri chromium	0.00	(ppm)
#8: Hex chromium	0.00	(ppm)
#8: Cyanide	0.00	(ppm)
#8: Zinc	3.90	(ppm)
#8: Iron	0.07	(ppm)
#8: Nickel	8.68	(ppm)
#8: Copper	24.53	(ppm)
#8: Cadmium	0.01	(ppm)
#8: Lead	0.07	(ppm)
#8: Number of rinse stations	9	
#8: Number with flow reduction	4	
#8: Number which could have reduction	5	

PLANT IDENTIFICATION

#9: Plant number	9	

PLANT DESCRIPTION

#9: Plant code	9	
#9: Hours of operation	8	(hours/day)
#9: Days of operation	240	(days/year)
#9: Existing plant processes	0	(0-4)
#9: X location	1.00	(miles)
#9: Y location	0.00	(miles)
#9: Route	1	

CYANIDE STREAM

#9: Stream flow	1235	(gal/day)
#9: Tri chromium	0.00	(ppm)
#9: Hex chromium	0.00	(ppm)
#9: Cyanide	29.60	(ppm)
#9: Zinc	0.00	(ppm)
#9: Iron	0.00	(ppm)
#9: Nickel	0.00	(ppm)
#9: Copper	0.00	(ppm)
#9: Cadmium	0.00	(ppm)
#9: Lead	0.00	(ppm)
#9: Number of rinse stations	4	
#9: Number with flow reduction	4	
#9: Number which could have reduction	0	

ACID/ALKALI STREAM

#9: Stream flow	3100	(gal/day)
#9: Tri chromium	0.00	(ppm)
#9: Hex chromium	0.00	(ppm)
#9: Cyanide	0.00	(ppm)
#9: Zinc	3.71	(ppm)
#9: Iron	1.80	(ppm)
#9: Nickel	17.10	(ppm)
#9: Copper	16.30	(ppm)
#9: Cadmium	0.00	(ppm)
#9: Lead	0.08	(ppm)
#9: Number of rinse stations	4	
#9: Number with flow reduction	3	
#9: Number which could have reduction	1	

PLANT IDENTIFICATION

#10: Plant number	10	

PLANT DESCRIPTION

#10: Plant code	10	
#10: Hours of operation	11	(hours/day)
#10: Days of operation	192	(days/year)
#10: Existing plant processes	0	(0-4)
#10: X location	1.00	(miles)
#10: Y location	0.00	(miles)
#10: Route	1	

CYANIDE STREAM

#10: Stream flow	23010	(gal/day)
#10: Tri chromium	0.00	(ppm)
#10: Hex chromium	0.00	(ppm)
#10: Cyanide	64.27	(ppm)
#10: Zinc	0.00	(ppm)
#10: Iron	0.00	(ppm)
#10: Nickel	0.00	(ppm)
#10: Copper	0.00	(ppm)
#10: Cadmium	0.00	(ppm)
#10: Lead	0.00	(ppm)
#10: Number of rinse stations	19	
#10: Number with flow reduction	10	
#10: Number which could have reduction	7	

ACID/ALKALI STREAM

#10: Stream flow	25640	(gal/day)
#10: Tri chromium	3.73	(ppm)
#10: Hex chromium	0.00	(ppm)
#10: Cyanide	0.00	(ppm)
#10: Zinc	8.12	(ppm)
#10: Iron	5.88	(ppm)
#10: Nickel	37.30	(ppm)
#10: Copper	26.50	(ppm)
#10: Cadmium	0.00	(ppm)
#10: Lead	0.04	(ppm)
#10: Number of rinse stations	17	
#10: Number with flow reduction	2	
#10: Number which could have reduction	15	

APPENDIX C

APPLICATION GUIDELINES AND PROCEDURES FOR REVENUE BOND FINANCING

U.S. SMALL BUSINESS ADMINISTRATION

POLLUTION CONTROL FINANCING GUARANTEE PROGRAM

APPLICATION GUIDELINES AND PROCEDURES FOR REVENUE BOND FINANCING
(Revised October 1979)

These revised application guidelines and procedures under which the Small Business Administration will operate the Pollution Control Financing Guarantee Program (revenue bond financing method) will continue to be changed from time to time as experience dictates. Rules and Regulations have been published and are incorporated herein by reference.

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I. INTRODUCTION

A. Background:

Public Law 94-305, authorizes SBA to guarantee the full amount of payments due under qualified contracts (as defined in section 111.3 of the Rules and Regulations) entered into by small business concerns which are, or are likely to be, at an operational or financing disadvantage with other businesses for the purpose of acquiring pollution control facilities. The law states that:

1. Notwithstanding any other law, rule, or regulation or fiscal policy to the contrary, the guarantee authorized in the case of pollution control facilities or property may be issued when such property is acquired by the use of proceeds from industrial revenue bonds which provide the holders interest which is exempt from Federal income tax.

2. Any such guarantee shall be for the full amount of the payments due under such qualified contract and shall be a full faith and credit obligation of the United States.

3. No guarantee shall be issued by the Administration unless the Administration determines that there exists a reasonable expectation that the small business concern in behalf of which the guarantee is issued will perform the covenants and conditions of the qualified contracts.

Tax-exempt bond financing for pollution control facilities or property provides the borrower with the most advantageous interest rate and repayment terms possible. It is, and has been, extensively utilized by large businesses for their financing of pollution control facilities. Small businesses, because they are primarily local or regional in nature and account for only a very small percentage of their industry's output, do not generally have access to the bond market for their financing needs.

To implement its full authority under Public Law 94-305, SBA is cooperating with commercial banks, State and local authorities, investment bankers, insurance and surety companies, and others to make long-term, low interest financing available to well-established larger small businesses.

B. Scope:

In utilizing bond financing the pollution control financing requirements of several eligible small businesses may be combined into a single bond offering. This not only enhances the market-

ability of the bonds by increasing the size of the offering but also minimizes the cost of issuance for each small business involved. Sufficiently large, single company bond financings may also be economically feasible.

SBA guarantees 100 percent of the principal and interest payments due under the qualified contract between each small business concern and the bond issuing authority. This guarantee carries the full faith and credit of the United States. Such bond issues carry a AAA rating and are a sought-after investment of many institutional and individual investors.

In those instances when revenue bond financing is uneconomic (usually for individual financings of under $100,000), or when the pollution control facility or property does not qualify (under IRS Regulations) for tax-exemption, financial assistance may be available through SBA's air or water pollution, or regular business loan programs.

II. APPLICATION PROCEDURES

The small business concern, usually assisted by the qualified sponsor (see section C below), must complete Part I of SBA Form 1136, "Application for Pollution Control Financing Guarantee," and submit it, along with the required documents and exhibits listed in section B below, to the qualified sponsor which coordinates the remaining procedures with the underwriter (see section E below), bond counsel and the bond issuing authority (see section F below).

A. Basic Requirements:

The law requires SBA to make a determination that a reasonable expectation exists that the applicant small business concern can meet the conditions and convenants of the underlying qualified contract.

Because SBA recognizes that there is substantial risk involved in guarantying 100 percent of the payments on long-term contracts where the pollution facility or property involved is generally a non-income producing asset, the following basic eligibility requirements have been established:

1. Size Determination: Together with its affiliates, the applicant small business concern must meet the size standards set forth in 13 CFR Section 121.3-16, SBA Rules and Regulations.

"§ 121.3-16 - Definition of small business for the purpose of pollution control guarantee assistance under Public Law 94-305."

A small business concern, for the purpose of pollution control guarantee assistance under Public Law 94-305, is a concern that qualifies as small under § 121.3-11."

"§ 121.3-11 - Definition of small business for assistance by small business investment companies or by development companies.

A small business concern, for the purpose of receiving financial or other assistance from small business investment companies or development companies is one which:

a. Together with its affiliates, is independently owned and operated, is not dominant in its field of operation, does not have net worth in excess of $6 million, and does not have an average net income, after Federal income taxes, for the preceding 2 years in excess of $2 million (average net income to be computed without benefit of any carryover loss); or

b. Qualifies as a small business concern under § 121.3-10."

2. Financing or Operational Disadvantage: The small business concern is, or is likely to be, at an operational or financing disadvantage with other business concerns with respect to the planning, design, installation of pollution control facilities or property, or the obtaining of financing for such facilities.

3. Longevity and Profitability: The applicant small business concern must be in business for a minimum of five years, and have a history of profitable operations for any three of the last five years.

4. Evidence: The small business concern must provide evidence from a Federal, State, or local environmental regulatory authority that the facility is likely to help prevent, reduce, abate, or control pollution or contamination. (See B 9. below).

5. Term: The repayment period for the pollution control financing shall not exceed 30 years.

6. Amount: The principal amount to be financed under a qualified contract shall not exceed $5,000,000.

a. Generally included in the principal amount financed are:

(1) All eligible costs connected with the construction

and/or installation of the pollution facility or property including, but not limited to, material and equipment, engineering, planning, design, site preparation, etc. and

(2) Attorney's fees, bond counsel fees, State and local fees, official statement and bond printing costs, the required escrow (see section IV, 1(a), below), and SBA fees.

B. Additional Requirements:

The small business concern is required to submit the following information with its application:

1. SBA Form 912, "Statement of Personal History," on all officers, director, holders of 20 percent or more of the voting stock; all partners and proprietor of the applicant small business. (This form can be obtained at any local SBA office.)

2. Annual financial statements for the preceding five(5) fiscal years. (Audited statements for the most recent year, or for all 5 years may be required by SBA.)

   a. Standards for Audited and Unaudited Financial Statements

   Financial statements include three basic statements - balance sheet, income statement, and statement of change in financial position. The statements are to be prepared in accordance with generally accepted accounting principles adopted by the Financial Accounting Standards Board (FASB), and have adequate footnoot disclosure so as to make the statements not misleading.

   When audited statements are required, such audits are to be made by an independent auditor in accordance with generally accepted accounting standards.

3. Interim financial statement (not older than 90 days).

4. Two years pro forma cash flow after giving effect to the financing applied for.

5. Most recent financial statements on all affiliates listed in item No. 4 of the application.

6. A brief history of the applicant small business, including type of business, method of operation, date established, ownership composition, and background experience of key management personnel.

7. Copy of the appraisal of the value of other collateral (if required) tendered as additional security for the financing (including the existence and amount of outstanding liens thereon).

8. Copy of bid proposals or estimates including plans and specifications for the pollution equipment or property, construction/installation, etc.

9. An in-furtherence certificate from the appropriate environmental regulatory authority stating essentially that the pollution control facility, when completed in accordance with the plans and specifications, will help prevent, reduce, abate, control noise, air, or water pollution or contamination by removing, altering, disposing or storing pollutants, contaminants, wastes, or heat, or property used for the collection, storage, treatment, utilization, processing, or final disposal of solid or liquid waste.

10. An opinion from the consulting engineer/architect responsible for the design of the facility, that the facility, when completed, will meet the required pollution control standards or regulations.

While not specifically required from each applicant, sound judgment dictates that:

a. On a case-by-case basis, SBA may require third party guarantees and/or additional (other than the pollution facility) tangible security, and

b. When outside contractors are used for construction and/or installation of the facility the applicant may wish to consider the advantages of a surety bond.

C. The Qualified Sponsor:

Because of its close financial relationship to the applicant, the qualified sponsor will usually be the bank of account of the small business concern. In addition to completing Part II of the application (SBA Form 1136) and assisting the small business concern prepare its part of the application for SBA assistance, the sponsor is asked to prepare a complete financial and credit analysis of the small business concern (including affiliates) and to issue an opinion and recommendation as to the applicant's creditworthiness for the financing in accordance with its and SBA's established credit criteria and requirements (section D, below). This opinion, analysis and recommendation is made with no liability on the part of the sponsor. (See Appendix I) While SBA relies upon the analysis and recommendation, final determination whether or not to issue its guarantee rests with SBA.

In addition to the documentation and exhibits received from the small business concern (including those in section II, B, above) the qualified sponsor submits the following to SBA:

1. A summary review of the financial statements of the applicant small business for the last five(5) fiscal years and the interim period (not older than 90 days).

2. Two up-to-date credit reports on the applicant small business and all affiliates (not older than 60 days from date of submission).

3. Its statement (Appendix I) of opinion and recommendation (signed by two officers - one a senior officer), regarding the applicant's creditworthiness for the financing requested, including an analysis made in accordance with its and SBA's established credit criteria.

4. A statement of opinion as to why the applicant small business is at a financing or operational disadvantage with other business concerns for the financing of its pollution control facility.

The financial analysis performed by the sponsor must include the composition and adequacy of the small business concern's:

1. Annual fixed debt requirement.

2. Past and projected earnings.

3. Working capital sufficiency to support the required pollution control project.

4. Debt to net worth ratio.

5. Realistic cash flow projections to meet the pollution control financing indebtedness and other amortized debt.

6. Economic outlook of the industry of which the small business is a part.

7. Interim financing, if required.

8. The age, health, and track record of principals (management).

9. The likelihood for the need to purchase management and/or technical assistance.

10. When tax-exempt bond financing is used, the additional financing necessary, if the entire amount of the pollution control facility's financing is not eligible under this program.

D. Credit Criteria and Requirements

The statute requires that before SBA can issue its guarantee, it must determine that the applicant small business concern meets the eligibility requirements (section II, A, above) and that there exists a reasonable expectation that it will perform the covenants and conditions of the qualified contract. Accordingly, SBA has established certain credit criteria to satisfy this requirement. They are:

1. That the applicant's general business trends compare favorably to that of its industry.

2. That the pro forma cash flow of the applicant reflects its ability to meet the obligations under the qualified contract as well as the additional debt burden of maintenance and service of the facility.

3. That the pro forma cash flow, current ratio, and tangible net worth ratio after consideration of the new financing, are realistically adequate for the applicant to meet its obligations under the proposed pollution control financing.

The procedures to determine eligibility and creditworthiness of the applicant business will be a complete review and analysis of the application, financial information, certifications, etc., by the qualified sponsor, the issuer of the bonds and/or an underwriter (section E below), and SBA.

E. The Underwriter

The underwriter (a commercial bank or investment dealer) assists the small business concern, sponsor, issuer, bond counsel and SBA in constructing and completing an bond issue. This includes assisting the qualified sponsor and the small business applicant during the application process; answering questions, packaging information, collecting and forwarding administrative fees to SBA,etc. In general the underwriter coordinates the many activities required to complete the bond offering, and usually purchases the bonds from the issuer to make a public or private distribution.

F. The Issuer

The issuer is the duly constituted State or municipal authority which is eligible by statute to issue bonds, and will usually be the entity to request SBA's commitment for guarantee (SBA Form 1136A (7-77) (See Appendix II) Each request from the issuer for SBA's guarantee must be accompanied by the inducement resolution of the authority to provide the financing through revenue bonds (taxable or tax-exempt) (if not already furnished).

G. The Trustee

The trustee is a fiduciary which acts as the assignee of the issuer in performing such duties as are required within the trust indenture. It may be a commercial bank or other eligible entity empowered by law to perform a trustee function. These functions generally include receiving periodic payments of principal and interest under the qualified contracts, investing those funds and the escrow funds, paying interest to the bondholders and redeeming the bonds as they mature, and notifying the obligee and SBA in the event of default.

H. SBA Commitments

When the review and analysis procedures have been completed and SBA determines that all criteria have been met, a commitment letter will be issued by SBA stating the terms and conditions under which a guarantee will be issued.

I. Bond Closing

When the small business concern executes the qualified contract SBA will issue its guarantee to the obligee. It is not necessary for all small business participating in a single bond issue to close their transaction at the same time. Closings may be staggered at the convenience of the obligor or obligee, provided it is accomplished prior to the expiration date of SBA's commitment.

Upon SBA's issuance of its guarantee the remainder of the processing and administrative fee and the guarantee fee is payable to SBA. (See Section III, below.)

At each closing all required documents and certifications must be furnished to SBA (if not already provided). In addition to those previously mentioned, the following are also required:

1. The final executed qualified contract between the small business concern (obligor) and the obligee.

2. The bond counsel's opinion as to the tax-exempt status of the bonds.

3. The executed bond indenture.

4. The bond purchase agreement.

5. The certification of the named trustee empowering it to act as trustee.

6. The final, executed trust indenture.

7. Any other pertinent closing documents including but not limited to (a) executed security agreements (if required), (b) executed personal guarantees (if required) and bond councel's letter regarding document authenticity.

III. DETERMINATION OF FEES

A. Guarantee Fee:

The law provides for a maximum guarantee fee of 3½ percent. SBA has determined that the guarantee fee shall be set at the maximum 3½ percent of the guaranteed amount, payable upon issuance if its guarantee.

The guarantee fee is computed as follows:

Total amount of principal and interest guaranteed
Less: Three months required escrow payments (see section IV, 1(a), below x 3.5 percent.

B. Processing and Administrative Fees:

The law permits SBA to fix a uniform fee for processing and administrative expenses in connection with the applications for guarantee under this program. Experience indicates that it takes approximately 30 hours of professional and clerical time to process each application. Additionally, the cost of administering each guarantee is estimated to be approximately $30 per year (assuming no defaults). Accordingly, SBA has determined that this one-time fee will be charged as follows:

$550 + ($30 x No. of years of the qualified contract)
(term of the contract)

Each application submitted to SBA must be accompanied by $250 of the above fee, which is not refundable. The remainder of the fee is payable to SBA upon issuance of its guarantee.

IV. LOSS MITIGATION

A. The statute contains certain provisions to help minimize the risks assumed by SBA under its guarantee. Among them are:

1. The requirement that the small business concern deposit ¼ of average annual guaranteed payments (3 monthly payments), required by the qualified contract, into an escrow account to be utilized first in the event of default by the small business. The escrow deposit will be left on deposit with the trustee and invested in securities which are acceptable to SBA. If there are no defaults through the life of the financing, the escrow amount plus interest thereon (if any) shall be used to make the final payments under the qualified contract.

2. That SBA, as the guarantor of the small business concern's payments under the qualified contract, will become a successor of the obligee (the issuer, lender, lessor, etc.) for the purpose of collecting from the obligor in default, including payments made by SBA under its guarantee.

3. That the obligee, when specifically requested by SBA, will act (or retain a duly licensed commercial bank to act) as SBA's agent for collection.

V. Documents - Legal Requirements:

Based on experience under the program to date SBA's office of General Counsel has prepared guidelines for bond counsel and others preparing those legal documents required for each financing. To expidite the review and approval of these documents these guidelines (see Appendix III) must be followed. It is also very helpful to submit these documents (Qualified Contract, Trust Indenture and preliminary Official Statement) to SBA's Office of General Counsel, 1441 L St. N.W., Washington, D. C. 20416, as early as possible for review. Particular attention etc..

Application forms are available from:

U. S. Small Business Administration
Office of Special Guarantees
Pollution Control Financing Division
1441 L Street, N.W.
Washington, D. C. 20416

Phone (703) 235-2902

SAMPLE

Note: The following is the sample of the Qualified Sponsor Bank Letter which must accompany its credit and financial analysis of the applicant (an example of which is attached). Please fill in the completed analysis signed by at least one Senior and an additional bank officer.

SPONSOR'S BANK

LETTERHEAD (Date)

To: (Name of Bond Issuing Authority)
("Authority")
and
Small Business Administration ("SBA")

Re: _____
Applicant

$_____

In connection with the financing of the above-named Applicant's pollution control project, as described and estimated in its application to you, ("Sponsor") supplies the following:

Credit of Applicant

1. Based on factual information contained in financial statements and supporting documentation which has been submitted and made available to Sponsor by the Applicant, Sponsor has determined that, based on an analysis of the financial condition of the Applicant made in accordance with Sponsor's and SBA's established credit criteria and procedures, such Applicant is creditworthy with respect to a financing by means of a bond issue of the Authority. Such analysis and conclusions are summarized as attached. The Sponsor believes that, to the best of its knowledge, the information on which it has based its determination is accurate, sufficient and truthful, but makes no representations as to the accuracy, sufficiency or truthfulness of such information and the results of the investigation that it has conducted, and Sponsor assumes no responsibility for any changes in such information subsequent to the date hereof, or for any independent investigation beyond that required by such credit criteria and procedures.

Status of Applicant

2. In the opinion of Sponsor, the Applicant would be at a financing or operational disadvantage with respect to other business concerns in obtaining financing for its pollution control requirements without the use of tax-exempt revenue bonds secured by a qualified contract bearing an SBA guarantee. The reasons for such disadvantage are summarized as attached.

Recommendation

3. The Sponsor, based upon the submission of Applicant and the Sponsor's determination, recommends that the financing of the Applicant's pollution control project be provided by means of revenue bonds to be issued by the _____ Authority.

The Sponsor certifies that the financial statements, supporting documentation and other submissions of the Applicant, together with Sponsor's analysis, reviews and conclusions which have led to its determination of Applicant's creditworthiness as of the date hereof, are in its files and are available for inspection by authorized representatives of the Authority and SBA.

* * * *

Note: The following analysis is meant to be used as an example, not to be followed word for word. Please use your bank's letterhead for each page.

BACKGROUND

(THE APPLICANT) _____ was started by _____ in (year) as a sole ownership and was subsequently incorporated in (date) . The company operates as a _____ and sells its products to the _____, _____ and _____ markets. The company and/or its Chairman of the Board, _____ _____, have been a customer of the (BANK) _____, and our experience with them has been _____.

The principal officers are _____, Chairman of the Board, age __; _____, President, age __; and _____, Controller, age __. To our knowledge, all are of excellent health and have broad experience in management and their industry.

All _____ divisions of (THE APPLICANT _____, Industrial, Decorative and Medical, have been expanding rapidly. The Industrial Division is now manufacturing a standard shelf product and consequently is establishing a nationwide distributor program. Projections indicate that this division will grow at a rate of ____% a year. Due to the increased use of _____ tapes in the auto aftermarket, the Decorative Division is also expanding rapidly. Increased acceptance in the market place and rapid expansion in disposable medical products has resulted in substantial increases in the Medical Division's products. Production capacity in the Medical Division is currently being doubled.

Overall, (THE APPLICANT _____'s production capacity has not been able to satisfy demand. Consequently, the company is in the process of relocating their facilities (currently 60,000 square feet) to a new situation in _____, with 122,000 square feet on 6 1/2 acres.

FINANCIAL

An analysis of the company's sales between 11/30/72 and 11/30/76 indicates rapid growth at 48%, 18%, 6% and 70% respectively. Gross margins are high and have fluctuated very little. Operating expenses have been well controlled and as a percentage of sales have increased from 22.5% in 1972, to 28.6% in 1976. Increased labor costs are primarily responsible for this increase. Net profit after tax has been maintained at a high and stable level. The company's liquidity and leverage are well within acceptable levels.

The nine month August 31, 1977 interim statement reflects a pre-tax profit of $198,000 or 4.2% on sales of $4,530,400. Liquidity and leverage continue to be well within acceptable levels. The company is projecting sales of $7.6 million for fiscal year end 11/30/77, which represents a 27% increase over 11/30/76. Sales for 11/30/78 are projected at $9.6 million.

Profitability is projected to increase during fiscal year 1978 due to increased production capacity and sales with the same labor base and an absolute reduction in production costs brought about by a more efficient operation and new manufacturing equipment.

An apparently conservative company, prepared cash flow projection indicates more than sufficient cash flow to service existing and new debt (see attached). The projection includes amortization of (YOUR BANK) $700,000 5-year term loan plus interest; interest on a $300,000 line of credit; and amortization of a $200,000 25-year SBA guaranteed loan at 6 1/4. A cash flow coverage computation based on the company's cash flow projection indicates debt coverage availability of 1.74:1 as follows:

Net Profit After Tax	826,000
Depreciation	156,000
Lease Expense	93,600
	1,075,600
*Debt Service (including interest)	226,000
Lease	93,600
Fixed asset expansion in 1978	300,000
	619,600

*Includes amortization of $200,000 25-year SBA guaranteed loan at 6 1/4%.

SUMMARY

It is the option of this bank that the subject company is creditworthy for the financing requested. The company has demonstrated a consistent record of profitability and growth over the last five years. Products are diversified

into three major categories which reduces the impact of a recessionary economy. The economic outlook appears very optimistic for all three of the company's major product lines. The company appears to have adequate management depth and is very well qualified with many years of experience in this industry.

The company's move to larger and more efficient facilities should further increase profitability, which even at present levels of operation appears to be more than adequate to service debt.

A current trade check of major suppliers is attached together with a copy of a 1975 Dun & Bradstreet report. A more current D & B has been ordered and will be forwarded when received.

The company would be at a financing disadvantage with respect to other business concerns in obtaining financing for its pollution control requirements without the use of revenue bonds guaranteed by the SBA. Obtaining this financing allows the company to gain access to the municipal bond market rates and repayment terms which our bank can not offer and which are not available in the conventional market.

Sincerely,

(SENIOR BANK OFFICER)_____

(BANK OFFICER_____

Pollution Control

Application Package Check List

Section:

I. SBA Application (SBA Form 1136)
History of the applicant and its management
Financial and Background information
on proposed guarantor(s) (if any)
Certificate of Incorporation (if a corporation)
SBA Forms 912s

II. Full description of the Pollution Control
facility including Bid proposals and/or
Estimates and Blueprints

Engineer's Certificate

In-furtherance Certificate

Issuer's Request for Commitment (SBA Form 1136-A)

Bond Inducement Resolution

III. Applicant's Financial Statements (5 years)
Interim Statements (not older than 90 days)
Pro Forma Cash Flow (2 years)
Credit Report (D&B)
Sponsor's Letter and Financial and
Credit Analysis (Appendix I)

IV. LEGAL
The following documents must be admitted for
approval to SBA's office of General Counsel as
soon as possible:
- Debt Instrument (Qualified Contract)
- Trust Indenture
- Collateral Agreement and/or Indemnification
- Document (if any)
Official Statement

February 1980

SMALL BUSINESS POLLUTION CONTROL BOND FINANCING

Application Procedures

1. Small Business Concern:

   a. Has to install pollution control equipment facility

   b. Determines what type of pollution control facility or equipment is needed.

   c. Goes to its bank to finance the acquisition of the required facility.

2. Bank (Oualified Sponsor) along with a bond issuing authority and an underwriter helps the small business concern prepare:

   a. Application for the authority to issue bonds.

   b. SBA's application and other required supporting documentation.

   c. Submits completed application package to SBA for analysis and approval.

3. Bond Counsel:

   a. Prepares legal documents to be used in the financing and submits to SBA's counsel for final approval.

      Documents include -

      (1) Debt instrument (Qualified Contract)

      (2) Trust Indenture

      (3) Preliminary Official statement

4. SBA reviews and analyzes application package to determine:

   a. Eligibility of small business concern.

   b. Small Businesses' creditworthiness.

   c. Businesses' compliance with other statutory requirements, then issues its commitment to guarantee.

5. Underwriter, bond counsel, and issuer:

   a. Request rating on the bonds (from Moody's or Standard and Poors).

   b. Finalize and distribute official statement (if a public offering).

   c. Have bonds printed.

   d. Set bond closing and bond sale date.

6. Bond Closing:

   a. Qualified contract and other necessary documents executed by lender, borrower, and trustee.

   b. SBA guarantee issued.

   c. Monies deposited into appropriate accounts.

Form Approved
OMB No. 100-R-0095

U.S. SMALL BUSINESS ADMINISTRATION

APPLICATION FOR POLLUTION CONTROL FINANCING GUARANTEE

PART I TO BE COMPLETED BY SMALL BUSINESS APPLICANT

Part I of this application must be completed by the Small Business Applicant in triplicate and submitted to the Qualified Sponsor. One copy each is to be retained by the Sponsor and the Underwriter. The original, along with a copy of each of the documents and exhibits required in the Application Guidelines and Procedures must be submitted to SBA. Omission of any item will result in delay. *(Use separate sheets if more space is needed).*

1. APPLICANT NAME AND ADDRESS *(Include County and Zip Code)*

TELEPHONE NO(S)

PRIMARY BUSINESS ACTIVITY

☐ CORPORATION ☐ PARTNERSHIP ☐ PROPRIETORSHIP ☐ FRANCHISE

☐ OTHER *(Specify)*

TOTAL NUMBER OF EMPLOYEES (Include those in No. 3)

EMPLOYER IDENTIFICATION NUMBER *(IRS No.)*

STANDARD INDUSTRIAL CODE *(SIC)* IF KNOWN

2. NAME AND ADDRESS OF ANY AFFILIATES *(Including SIC Code and Number of employees for each):*

3. APPLICANT HAS ☐ OUTSTANDING ☐ PREVIOUS ☐ NO SBA LOAN(S)

LOAN NO(S). SBA OFFICE

4. PERSPECTIVE GUARANTOR(S) *(If required)*

a. NAME & ADDRESS *(Include Zip Code)*

b. RELATIONSHIP TO APPLICANT *(Relative, Stockholder, Affiliate, etc.)*

c. FINANCIAL STATEMENTS FOR THE PAST FIVE (5) YEARS ENCLOSED (See Section II B2a of Guidelines)

5. REFERENCES OF APPLICANT

a. BANKING *(Include name of contact officer)*

b. MAJOR SUPPLIERS *(3 largest)*

c. MAJOR CUSTOMERS *(3 largest show % of applicant's total business obtained from each.)*

6. HAS APPLICANT EVER FINANCED THE ACQUISITION OF POLLUTION CONTROL FACILITIES OR EQUIPMENT? ☐ YES ☐ NO. IF "YES" THE METHOD OF FINANCING IS/WAS ☐ TAX EXEMPT ☐ TAXABLE REVENUE BONDS OR ☐ OTHER. IF "YES" EXPLAIN AND GIVE FULL DETAILS ON SEPARATE SHEET.

7. DOES THIS APPLICATION INCLUDE A REQUEST FOR REFUNDING *(refinancing)* OF OUTSTANDING POLLUTION CONTROL FINANCING? ☐ YES ☐ NO

8. POLLUTION CONTROL PROJECT INFORMATION

a. TYPE OF POLLUTION CONTROL TO BE FINANCED:

b. ESTIMATED USEFUL LIFE OF THE FACILITY/EQUIPMENT:

c. ESTIMATED ANNUAL OPERATING AND MAINTENANCE COSTS OF THE FACILITY/EQUIPMENT: $

d. ANTICIPATED STARTING DATE OF THE PROJECT:

e. ESTIMATED COMPLETION DATE:

ESTIMATED COST:	
CONSTRUCTION *(including installation materials and equipment)*	$
BOND ISSUANCE *(See Section II A.a.(1)(f) of Guidelines)*	$
TOTAL OTHER COSTS *(List separately)*	$
TOTAL PRINCIPAL	$

SBA FORM 1138 (1-81) PREVIOUS EDITIONS ARE OBSOLETE

AGREEMENTS:

1. The undersigned applicant agrees that this application is made pursuant to Title IV of the Small Business Investment Act of 1958, as amended, 15 U.S.C. 694-1 (P.L. 96-305) and that the cited law shall control transactions between the Small Business Administration and the applicant.

2. **SBA PERSONNEL**

In consideration of the issuance of the guarantee applied for in this application, applicant hereby agrees that for a period of 2 years after the effective date of the guarantee, applicant will not employ or tender any office or employment to, or retain for professional services, any person who, on the effective date of such guarantee or within one year prior to such date, (a) shall have served as an officer attorney, agent, or employee of SBA and (b) as such, shall have occupied a position or engaged in activities which SBA shall have determined, or may determine, to involve discretion with respect to the granting of assistance under any laws administered by the Small Business Administration or said laws as may be amended from time to time.

3. **INDEMNIFICATION**

In consideration of the guarantee under which the United States Small Business Administration (SBA) shall undertake to make certain payments under a certain qualified contract for the pollution control facility described herein between the undersigned (Obligor) and an Obligee in the event of default by the Undersigned (Obligor) thereunder, the undersigned (Obligor) hereby agrees to reimburse SBA for any and all sums which SBA would be required to pay under said guarantee, plus reasonable attorney's fees in connection therewith.

THE APPLICANT CERTIFIES THAT:

1. All information contained in this application and in the documents attached are true and correct to the best knowledge of the applicant and are submitted for the purpose of inducing SBA to guarantee the payments set forth in the approved qualified contract for pollution control facilities.

2. Applicant has not received, and is not aware of, any proposal of merger or other acquisition, which (if accepted) would affect its status as an eligible small business concern.

DISCLOSURE OF SPECIAL INFORMATION REGARDING PRINCIPALS:

a. List (on a separate sheet) the names and addresses of any SBA employees or SBA advisory board members who are related by blood, marriage or adoption, or who have any present financial interest in or in association with, the applicant, or any of its partners, directors or principal stockholders (such interest includes any direct or indirect financial interest in any other business entity or enterprise). If none, so state.

b. When the proprietor, or any partner, officer, director, or person who holds 10% or more of the applicant's stock, or their spouse, is an employee of the U.S. Government (including members of the armed forces), detailed information (including name(s), address(es) and details of relationship or interest) must be submitted (on a separate sheet) with this application, If none, so state.

A NON-REFUNDABLE $250 PORTION OF THE PROCESSING AND ADMINISTRATIVE FEE MUST BE SUBMITTED WITH THIS APPLICATION. THE REMAINDER OF THIS FEE AND THE GUARANTEE FEE (SEE SECTION III, A&B OF GUIDELINES) IS PAYABLE TO SBA UPON ISSUANCE OF ITS GUARANTEE.

AUTHORIZED SIGNATURE	TITLE	DATE

Any intentionally false statement in this application or willful misrepresentation relative thereto is a violation of federal law, which may subject you to criminal and civil prosecution, 18 U.S.C. Sections 287, 371, 1001, 15 U.S.C. Section 645, 31 U.S.C. Section 231, carrying fines up to $10,000 and imprisonment up to five years.

PART II TO BE COMPLETED BY THE QUALIFIED SPONSOR

1. SPONSOR *(Name, Address & Zip)*	2. SPONSOR'S ACCOUNT OFFICER OF SMALL BUSINESS APPLICANT
	NAME
	TITLE
	PHONE NO(S).

3. The undersigned certifies that the account file(s) which shall be maintained by the Qualified Sponsor named in item 1 of this Part II of the Small Business applicant named in item 1, Part I of this application shall be open at all reasonable times to review and/or audit by the Small Business Administration for the term of the financing.

AUTHORIZED SIGNATURE	TITLE	DATE

RESERVED FOR U.S. SMALL BUSINESS ADMINISTRATION USE

SBA FORM 1139 (1-80)

FORM APPROVED
OMB NO. 100-R-0085

U.S. SMALL BUSINESS ADMINISTRATION

Pollution Control Financing

ISSUERS REQUEST FOR GUARANTEE COMMITMENT

1. Issuer (Authority Issuing the Bonds)

NAME AND ADDRESS (INCLUDE ZIP)

CONTACT PERSON	TITLE	PHONE NO.

2. Small Business Applicant

NAME AND ADDRESS (INCLUDE ZIP)

3. AGGREGATE AMOUNT OF GUARANTY REQUESTED $	4. PRINCIPAL AMOUNT OF FINANCING

5. ESTIMATED NET INTEREST COST % DUE _____ (YEAR) _____

6. Trustee

NAME AND ADDRESS (INCLUDE ZIP)

CONTACT PERSON	TITLE	PHONE NO.

7. Underwriter(s)

NAME AND ADDRESS (INCLUDE ZIP)

CONTACT PERSON	TITLE	DATE

8. ANTICIPATED BOND SALE DATE:

SIGNATURE	TITLE	DATE

SBA FORM 1136A (10-77)